The Development and Part-Validation of a UK Scale for Mathematics Anxiety

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Abstract

There is a paucity of information surrounding maths anxiety levels in the British undergraduate student population and, due to terminological issues, existing measures of maths anxiety may not be appropriate measures to use with this population. The current study therefore reports on the development and validation of a new maths anxiety scale. Using a large sample of British undergraduates, the 23-item Mathematics Anxiety Scale-UK (MAS-UK) was shown to be a reliable and valid measure of maths anxiety. Exploratory factor analysis indicated the existence of three factors, highlighting maths anxiety as a multidimensional construct. Confirmatory factor analysis revealed a good-fitting model. Normative data on maths anxiety in a British undergraduate student population are provided, along with comparisons between academic undergraduate subject areas and genders. The MAS-UK may represent an easily administrable, reliable and valid tool for assessing maths anxiety in British and potentially European undergraduate student populations.

The Development and Part-Validation of a UK Scale for Mathematics Anxiety

The most commonly used definition of mathematics anxiety is that given by Richardson and Suinn (1972, p.551) who define it as "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". A number of lines of evidence provide support for the utility of this construct (Ashcraft & Moore, 2009) and there are several instruments available to measure it. Research into maths anxiety accelerated with the publication of the Mathematics Anxiety Rating Scale (MARS, Richardson & Suinn, 1972). The MARS consists of 98 five-point Likert-type items relating to involvement with maths across a range of settings. Richardson and Suinn reported a seven-week test-retest reliability of .85 and a Cronbach's alpha of .97. Capraro, Capraro and Henson (2001) reported that, across 28 studies, the MARS yielded a mean alpha of .915, and, across seven studies, it yielded a mean test-retest of .841, providing support for the MARS as a reliable scale. However, the administration of the 98-item MARS has proved to be somewhat cumbersome and there have been several attempts to produce shorter equivalents of the MARS (Alexander & Martray, 1989; Hopko, Mahadevan, Bare & Hunt, 2003). Whilst several maths anxiety scales are available, issues surrounding terminology may question their validity in measuring maths anxiety in non-North American samples.

There has been an increasing number of studies investigating the dimensionality of maths anxiety across recent years. Rounds and Hendel (1980) performed principal axis factoring on 94 of the 98 items on the MARS and found two factors, with oblique and orthogonal rotations resulting in similar outcomes. The first factor they termed Mathematics Test Anxiety and consisted of items such as "thinking about an upcoming maths test one day before". The second factor they termed "Numerical Anxiety" and consisted of items such as "adding up 976 + 777 on paper". Thus, factor one pertained to items related to having maths ability tested and also general learning of maths, whereas factor two pertained to items related to more direct calculations and everyday use of maths. Alexander and Martray's (1989) abbreviated version of the MARS had three factors, "Maths Test Anxiety", "Numerical Task Anxiety", and "Maths Course Anxiety", which appeared to encompass the factors previously suggested. Resnick, Viehe and Segal (1982) also identified three dimensions in the MARS. The first two, "Evaluation Anxiety" and "Arithmetic Computation Anxiety" closely resemble the two factors outlined by Rounds and Hendel (1980), whereas the third factor, "Social Responsibility Anxiety", relates to social maths settings, such as accounting and secretarial duties in clubs and organisations. Bessant (1995) found six factors using a reduced, 80-item, version of the MARS but these appear to fall into the general dimensions of numerical-based and evaluation-based maths anxiety.

The majority of normative data for maths anxiety, along with studies of psychometric properties of maths anxiety scales, has been conducted on an American student population. In the published literature there appears to be no normative data available for a British population (Sheffield & Hunt, 2007). The purpose of the present study was threefold. Firstly, the issue of terminology needed to be addressed. UK samples may find some terminology difficult to understand. For example, the original MARS contains several such items, e.g., the term "being asked to make change" is not common in Britain. Likewise, the item "being given a "pop" quiz in maths class" has resulted in several students having to ask the researcher what this means. This item appeared on the original MARS and the revised version proposed by Hopko (2003). A further example is the term "sales tax" (MARS) and has resulted in some British participants being unsure of its meaning. Such terminological problems are clearly a concern for the validity of the scales. We have therefore devised a scale designed to measure maths anxiety in a British population, using terminology appropriate to the population. The second purpose of the study is to provide some much needed normative data concerning maths anxiety levels in a British student population, including separate analyses for gender and different academic subject areas. In particular, consistent with previous findings, e.g., Hembree (1990), it is predicted that females will score more highly than males in maths anxiety and subject areas with less maths course content will demonstrate higher levels of maths anxiety. Thirdly, we aim to present the psychometric properties of the newly devised scale, including its factor analytic structure. Reliability and validity measures may prove useful in determining the usefulness of the scale as a diagnostic tool in the adult education sector, as well as being an important measure for subsequent empirical research.

Method

Participants

Participants were 1, 153 (544 males (47.18%), 609 females (52.82%)) undergraduate students at Staffordshire University; a typical post-1992 University in the Midlands, UK. The proportion of males and females in the sample was equivalent to the national University average of 48.64% and 51.36% for males and females, respectively (Higher Education Statistics Agency, HESA, 2008-09). The sample predominantly consisted of participants of white ethnic origin, although it also included participants from other backgrounds, including Asian and Afro-Caribbean. The proportion of white participants was in the region of the national University average (approximately 79.2%: HESA, 2008-09). The mean age of students was 21.1 years (SD = 4.9). The sample included participants from all three years of undergraduate study and the mean age is typical of the age of a student mid-way through their studies. The mean age is slightly higher than would be expected from a student sample at traditional Universities, but is consistent with the slightly higher ages of students in post-1992 Universities in the UK, which actually make up approximately half of the number of Universities in the UK (Universities Colleges and Admissions Service, 2009). Therefore, the sample was representative of the UK undergraduate population enrolled on full-time taught degrees. Participants were recruited using opportunity sampling from various lectures, workshops and seminars. Participation was entirely voluntary. The retest sample consisted of an opportunity sample of 131 of the original sample (41 males, 96 females, mean age 20.1 years, SD = 5.4). Retest occurred between four and ten weeks. Unfortunately, the programme of lectures finished earlier than scheduled for some subjects, resulting in fewer students than expected available for retest.

Specific degree subjects fell into five main faculties; these were: Sciences (29.9%), Arts, Media and Design (28.9%), Health (21.3%), Business (13.8%), and Computing, Engineering and Technology (6.1%). It is worth pointing out that Psychology, sometimes classified as a social science, was part of the Science faculty, with Psychology students making up the majority (83.6%) of participants from this faculty in the current study.

To test construct validity an opportunity and voluntary sample of 283 (87 males, 196 females, mean age = 23.19 years (SD = 7.08)) undergraduate students was used. This included 64 (22.6%) of the same participants from the main study and the slightly higher mean age was due to participation mostly of students from their second or third year of study.

Missing Values

A missing values analysis of the main study data showed that no variable had more than 5% missing cases. After listwise deletion, the sample size was reduced to 1, 123 for the factor analysis of items. The sample size was deemed to remain sufficiently large, with 97.4% of the original sample, not to warrant an imputation method for missing values. Listwise deletion was employed for all other analyses, including the test-retest reliability analysis. There were no missing values in the sample used to test construct validity.

Mathematics Anxiety Scale-UK

Consistent with previous maths anxiety measures, the newly devised Mathematics Anxiety Scale – UK (MAS-UK) includes a series of statements concerning situations involving maths. For each statement participants are required to respond by indicating how anxious they would feel on a five-point Likert-type scale, ranging from “not at all” to “very much”. Initially, 38 items were devised (see Appendix). These were based on the types of statements used within previously validated scales, along with statements that the researchers felt were appropriate for a British population informed by discussions with undergraduate students during debriefing after taking part in the authors’ previous research (e.g., Sheffield & Hunt, 2007). Of the initial 38 items, 10 were completely original in comparison to previously validated maths anxiety scales. These were designed to specifically reflect maths experiences of students from a British population, e.g., including one item relating to the game of darts – a common game played in the UK that involves arithmetic. The remaining items were based on those currently available in the MARS (Richardson & Suinn, 1972) or subsequent versions (e.g., Suinn & Winston, 2003), but were re-worded and were seen as remaining representative of maths experiences of a UK undergraduate population, e.g., items related to classroom contexts.

Initial piloting of the scale on 160 undergraduate Psychology students revealed all items to be correlated with the overall scale (minimum r was .48), all items had strong discriminatory power (as assessed using between-subjects t-tests, $p < .001$, comparing participants at the top and bottom quartiles of the total scale score) and Cronbach’s alpha was .96, with no removal of items leading to an improved alpha. All items were therefore retained for the main study, meaning that scores could potentially range from 38 to 190.

Other Measures

In order to test the construct validity of the new maths anxiety scale, measures of general trait anxiety and maths ability were taken. Trait anxiety was assessed using the trait scale of the State-Trait Anxiety Inventory (Spielberger, Gorsuch, Lushene, Vagg & Jacobs, 1984). General maths ability was assessed using a set of untimed 36 mental arithmetic problems, devised to include the four main problem types (addition, multiplication, subtraction & division). These ranged from single-digit problems, e.g., 10 ÷ 2, to three-digit problems, e.g., 926 – 763. Overall ability was calculated by the total number of correct responses.

Analyses

Prior to conducting an exploratory factor analysis of the 38-item scale, initial data screening revealed most of the items to be highly positively skewed, with some also being highly leptokurtic. Various transformations (reciprocals, logarithms and fractional powers) were attempted but none sufficiently normalised the data. Consequently, items five and ten were removed from the analysis as these had skewness greater than +/- 3 and/or kurtosis +/- 8 and could be considered to be extreme departures from normality (West, Finch & Curran, 1995). In order to attend to the issue of non-normality in the remaining data generally, later analysis included the implementation of the bootstrap procedure. Observation of a random selection of scatterplots revealed no indication of non-linearity amongst items. Plotting Mahalanobis' distance values indicated one potential multivariate outlier that was situated far from the other cases. Confirmatory analysis of the model on the overall sample showed no difference in the results when the outlier was included or excluded. The following results are based on analysis with the exclusion of the outlier. We employed three commonly used methods for identifying factors: eigenvalues greater than unity, observation of the point of inflexion on the scree plot, and parallel analysis. Parametric assumptions for all other analyses, including homogeneity of variance, univariate normality and linearity of relationships, were met unless otherwise stated.

Results

Descriptive Data

For the main sample, overall mean maths anxiety was 78.79 (SD = 26.37). A 2 (gender) x 5 (Faculty) two-way between-subjects ANOVA showed a significant main effect of gender, such that females (mean = 82.30, SD = 27.93) were significantly more anxious than males (mean = 74.84, SD = 23.92) ($F_{(1, 1112)} = 10.58$, $p < .005$, $\eta^2 = .008$)). There was also a significant main effect of Faculty ($F_{(4, 1117)} = 18.67$, $p < .001$, $\eta^2 = .058$; see table 1). Follow-up contrasts using Tukey's HSD showed that maths anxiety in the Arts, Media and Design faculty was significantly greater than all other faculties excluding Sciences, and the faculty of Sciences had significantly greater anxiety than the Health and Business faculties. Both the Computing and Health faculties also showed significantly greater anxiety than the Business faculty (all $p<.05$). There was no significant interaction between gender and Faculty ($F_{(4, 1112)} = .05$, $p = .995$, $\eta^2 < .001$).

Age was significantly positively correlated with maths anxiety ($p < .01$, two-tailed). Nonetheless, the relationship was small ($r = .09$).

[insert table 1 here]

Exploratory Factor analysis

Principal axis factoring was employed using a direct oblimin rotation. A high Kaiser-Meyer-Olkin measure (KMO = .973) indicated that sampling adequacy was met and very low values in the diagonal of the anti-image correlation matrix provided further evidence that the data were suitable for factor analysis (Tabachnick & Fidell, 2001). The mean correlation between extracted factors, based on eigenvalues above one, was .43, thus indicating non-orthogonality amongst factors and therefore verifying the decision to use a direct oblimin rotation. Initially, using eigenvalues above one as criteria for factor extraction, four factors were extracted. The four factors explained a total of 53.7% of the variance, with 42.6%, 4.8%, 4.5%, and 1.9% of the total variance, being explained by factors one to four respectively. Based on Comrey and Lee's (1992) suggestion that factor loadings in excess of .45 can be considered good, the pattern matrix was explored for factor loadings .45 or higher. This revealed several items that did not load sufficiently on to a single factor. An observation of the scree plot indicated the existence of three factors. This was confirmed via parallel analysis in which only the first three eigenvalues exceeded the criterion values based on 100 random datasets. Therefore, the analysis was re-run specifying the extraction of three factors. The result was a much more parsimonious factorial structure in which 51.7% of the total variance was explained by the three factors. 42.5%, 4.7%, and 4.5% of the variance was explained by factors one to three respectively. Of the 36 items, 27 had factor loadings of at least .45 but four of those items also loaded on to more than one factor; item 3 loaded on to factors 1 and 2, and items 27, 31, and 35 loaded on to factors 1 and 3 (see Appendix for item labels). Therefore, 23 items were retained (see table 2).

[insert table 2 here]

Internal Consistency

Discriminative power analysis using between-subjects t-tests showed that the all items significantly ($p < .001$) distinguished between the top and bottom quartiles of the overall scale. A high level of discriminatory power was also found ($p < .001$) when the quartiles were based on sub-samples. Cronbach's alpha for the overall scale was excellent ($\alpha = .96$), as well as for sub-scales one to three ($\alpha = .92$, $\alpha = .85$, & $\alpha = .89$, respectively).

Test-retest Reliability

Test-retest reliability was excellent for the overall scale ($r_{(129)} = .89$, $p < .001$), sub-scale one ($r_{(129)} = .90$, $p < .001$), sub-scale two ($r_{(129)} = .73$, $p < .001$), and sub-scale three ($r_{(129)} = .80$, $p < .001$).

Factor Labelling

Items loading on to factor one appear to relate to evaluation of maths ability. These items include reference to testing and examination, and calculation in front of others. Therefore, we have labelled the first factor Maths Evaluation Anxiety. Items loading on to factor two appear to relate to calculations that occur in everyday situations, such as adding up a pile of change or having to remember a telephone number. Some of these items also include social implications, e.g., it is obvious to imagine the potential consequences related to the ability to calculate the number of days until a person's birthday or the ability to turn up to work on time. Therefore, we have labelled the second factor Everyday/Social Maths Anxiety. The third factor includes items that appear to relate to observation of maths without any direct calculation. For example, watching a teacher or lecturer write equations on the board or reading a maths text book clearly involve being in a maths context but do not require any direct testing or manipulation of number on the part of the participant. Therefore, we have labelled the third factor Maths Observation Anxiety.

Confirmatory Factor Analysis

For further testing of construct validity, we performed a confirmatory factor analysis of the previously extracted factor using AMOS 17. Data were initially assessed for multivariate normality using Mardia's coefficient for multivariate kurtosis, which revealed a high degree of multivariate non-normality (Mardia's coefficient = 203.36, critical ratio = 100.44, for $p = .01$). As goodness of fit indices have been shown to be affected by non-normality we tentatively interpreted these prior to performing the bootstrap procedure to assess the parameter estimates. Confirmatory analysis of the three factors using maximum likelihood estimation resulted in a very large and significant chi-square statistic (χ^2 (227) = 1546.13, $p < .001$), however, chi-square is sensitive to sample size (Tabachnick & Fidell, 2001) and non-normality (Henly, 1993; West et al, 1995). Therefore, other goodness of fit measures were considered. CFI = .91 and TLI = .90, both representing an adequate fit by convention, and RMSEA = .07 (CI = .069 to .075), which is less than the .08 cut-off for an adequate fit (Browne & Cudeck, 1993) and close to the recommended .06 cut-off for a good-fitting model (Hu & Bentler, 1999). The standardised RMR was .05, which is less than the .08 cut-off recommended by Hu and Bentler and therefore represents a very good fit. No modification indices indicated obvious improvements to the model. As multivariate non-normality in the data was high, the bootstrap procedure using 1000 samples was employed. Standardised path coefficients ranged from .502 (item 13) to .834 (item 20), with a mean of .72. Standard errors for the bootstrapped estimates were almost identical to the standard errors in the original model. The bias-corrected confidence intervals around the regression weights for path estimates indicated that each would have to be at least at the 99.9% level before the lower bound value would be zero, thus presenting strong evidence for a well-fitting model. Similarly, the model fitted well for both males (CFI = .90, TLI = .89, RMSEA = .07, SRMR = .06) and females (CFI = .91, TLI = .90, RMSEA = .08, SRMR = .06), with bias-corrected confidence intervals indicating that the regression weights for path estimates would have to be at least at the 99.7% level before the lower bound value would be zero.

Due to the variation in sample size, including low participant numbers across faculties, we tentatively interpreted the results of a confirmatory factor analysis across four of the faculties, preferring to consider the standardised mean residuals and RMSEA, as these have been shown to be goodness of fit measures least affected by sample size (Hu & Bentler, 1998). Bootstrapped bias-corrected 90% confidence intervals around the regression weights were also considered as a key measure of model fit. The Computing faculty was excluded from the analysis due a particularly low sample size (n = 69). Results showed that the standardised mean residuals ranged from .06 to .08. RMSEA ranged from .07 to .10. Bootstrapped bias-corrected confidence intervals around the regression weights for the path coefficients indicated that each would have to be at least at the 99.7% level before the lower bound value would be zero. Together, this indicated an adequate to good model fit across faculties.

Construct Validity

The mean number of correct responses on the basic maths test was 29.04 (81%) with an SD of 4.24. Mean maths anxiety was 79.18 (SD = 26.08) and mean trait anxiety was 45.36 (SD = 4.82). A significant and moderate correlation was found between maths anxiety and trait anxiety ($r_{(281)} = .22$, $p < .001$). Maths anxiety was also found to be significantly negatively correlated with basic maths performance ($r_{(281)} = -.40$, $p < .001$), but no significant relationship was found between trait anxiety and performance ($r_{(281)} = -.06$, $p = .31$).

Discussion

This study was designed to develop a measure of maths anxiety suitable for a British undergraduate student population. Three key aims were addressed. Firstly, items on the MAS-UK include terminology suitable for a non-North American population. Until now researchers wishing to study maths anxiety within a British population have used scales previously validated largely on a North American population. It is hoped that our newly devised scale will aid researchers using participants from a British population and will eliminate the need to modify existing scales. This, along with size of the scale (23 items), means that administration time is kept to a minimum. It is also possible that the MAS-UK might be useful for European studies.

Secondly, the current study provides normative data regarding maths anxiety in a British population. Of particular interest is the observed gender effect; as predicted, overall maths anxiety was significantly greater in females than males. This is consistent with several previous findings (e.g., Hembree, 1990; Baloglu & Kocak, 2006), although the actual effect size was very small. Also in line with our prediction, the highest maths anxiety levels were found in the Arts, Media and Design faculty. This is no surprise given that such subjects as Art and Journalism involve little to no maths content. The lowest maths anxiety levels were found in the Business faculty. Again, this is not surprising given that this faculty contains subjects such as Accountancy in which the maths content is comparatively high[1]. Maths anxiety levels amongst students studying in the Sciences faculty were higher than expected. One explanation for this could be that the majority of those students were studying Psychology, in which the maths content might exceed students' expectations. Unfortunately the University does not provide degrees in other science subjects, such as Physics or Chemistry, from which comparisons could be made with Psychology students, but one assumption is that maths anxiety levels would be less amongst students in the natural sciences.

Thirdly, the MAS-UK has a parsimonious factorial structure, with sub-scales that make intuitive sense. These are Maths Evaluation Anxiety, Everyday/Social Maths Anxiety, and Maths Observation Anxiety. The first sub-scale, Maths Evaluation Anxiety, explained the largest share (42.5%) of the variance in maths anxiety scores. This is in line with existing scales in which a maths evaluation or test anxiety sub-scale has been shown to explain most of the variance (e.g., Alexander & Martray, 1989), and provides some support for the validity of the new scale. The Everyday/Social Maths Anxiety sub-scale includes items related to everyday numerical calculations, often in a social context, whereas the Maths Observation Anxiety sub-scale includes items related to experience of maths without immediate involvement or direct calculation. It is worth noting that we have not

[1] It could be seen as counterintuitive that math anxiety was lower in the Business Faculty than in the Computing, Engineering and Technology Faculty, but it should be noted that Accountancy and Finance students made up the largest proportion of students in the Business Faculty and the Computing, Engineering and Technology Faculty sample comprised mainly of Entertainment Technology students, in which the math content of the course is much less than would be found in other specific, e.g., Computing, subjects. Further results relating to a breakdown of specific subjects in each Faculty are available from the authors upon request.

identified a separate numerical or calculation anxiety sub-scale. Careful observation of items potentially pertaining to such a factor suggests that subtle wording may have forced those items on to factors specific to a type of numerical anxiety. For example, even though it contains an explicit calculation, the item “being asked to calculate three fifths as a percentage” pertains to an evaluation of the person’s ability to calculate the problem successfully. This item loaded quite heavily on to the Maths Evaluation Anxiety sub-scale. Similarly, the item “calculating how many days until a person’s birthday”, again, involves “calculation” but is typical of items in the Everyday/Social Maths Anxiety sub-scale that pertain to maths specifically in a more everyday or social setting, as opposed to a learning environment. A confirmatory factor analysis demonstrated that the proposed model was a good fit and further testing showed the MAS-UK to have excellent internal consistency and high test-retest reliability. A separate study of construct validity found scores on the new maths anxiety scale to be significantly and moderately correlated with both basic maths performance and general trait anxiety. Absence of a correlation between trait anxiety and maths performance provided further support for the construct validity of the new scale.

Further testing of the psychometric properties of the MAS-UK, including tests of concurrent validity with existing measures of maths anxiety, is needed prior to its implementation as a diagnostic tool. However, the information presented here provides strong support for the reliability and validity of the scale as a measure of maths anxiety and supports previous findings that demonstrate maths anxiety to be a multidimensional construct. It is hoped that the MAS-UK proves to be a useful measure in future empirical research into maths anxiety and may be more suited to a British and potentially European undergraduate student population. Further work is needed in order to acquire normative data for maths anxiety in the general British and European populations for comparison with an undergraduate student population.

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Table 1

		Mean	SD
	Arts, Media & Design (n = 324)	85.79	27.86
	Sciences (n = 335)	82.12	27.12
Faculty	Computing, Engineering & Technology (n = 69)	76.55	22.25
	Health (n = 239)	74.14	22.26
	Business (n = 155)	65.13	22.44

Table 1. *Means and SDs of Maths Anxiety across Faculties*

Table 2

	Item	Factor / Loading		
		Maths Evaluation Anxiety	Everyday/Social Maths Anxiety	Maths Observation Anxiety
1.	Having someone watch you multiply 12 x 23 on paper	.69		
2.	Being asked to write an answer on the board at the front of a maths class	.75		
3.	Taking a maths exam	.68		
4.	Being asked to calculate £9.36 divided by four in front of several people	.78		
5.	Calculating a series of multiplication problems on paper	.47		
6.	Being given a surprise maths test in a class	.75		
7.	Being asked to memorise a multiplication table	.57		
8.	Being asked to calculate three fifths as a percentage	.63		
9.	Being asked a maths question by a teacher in front of a class	.80		
10.	Adding up a pile of change		.65	
11.	Being asked to add up the number of people in a room		.51	
12.	Calculating how many days until a person's birthday		.62	
13.	Being given a telephone number and having to remember it		.51	
14.	Working out how much time you have left before you set off to work or place of study		.60	
15.	Working out how much change a cashier should have given you in a shop after buying several items		.60	
16.	Deciding how much each person should give you after you buy an object that you are all sharing the cost of		.54	
17.	Working out how much your shopping bill comes to		.54	
18.	Reading the word "algebra"			.51
19.	Listening to someone talk about maths			.76
20.	Reading a maths textbook			.77
21.	Watching someone work out an algebra problem			.71
22.	Sitting in a maths class			.71
23.	Watching a teacher/lecturer write equations on the board			.62

Table 2. *Factor Loadings of Retained Items on the Mathematics Anxiety Scale-UK*

Appendix A

Items removed from the original 38 items on the Mathematics Anxiety Scale-UK (MAS-UK)

1. Calculating 20% off the price of an item of clothing in a shop.
2. Working out how much you would get paid if you worked for 8 hours at £6.22 an hour
3. Being asked to change a pound coin for someone.
4. Reading the word “maths”
5. Telling the cashier at a restaurant that you believe the bill is wrong.
6. Calculating and recording the scores your friends get in a darts game.
7. Having someone explain a maths problem and not understanding what they mean.
8. Working out a spending budget for the month.
9. Asking someone a question about a maths problem you don’t understand.
10. Being asked to add up 427 + 256 in your head.
11. Being told you need to attend a maths course at work or as part of your course.
12. Working out how much interest you need to pay on a bank overdraft.
13. Being given a series of subtraction problems on paper.
14. Handing in a maths homework assignment.
15. Being asked to solve the problem ‘if $2(x + 3) = 10$, work out the value of x’.

Appendix B

Mathematics Anxiety Scale-UK (MAS-UK)

How anxious would you feel in the following situations?........Please circle the appropriate numbers below.

		Not at all	Slightly	A fair amount	Much	Very much
1.	Having someone watch you multiply 12 x 23 on paper.	1	2	3	4	5
2.	Adding up a pile of change.	1	2	3	4	5
3.	Being asked to write an answer on the board at the front of a maths class.	1	2	3	4	5
4.	Being asked to add up the number of people in a room.	1	2	3	4	5
5.	Calculating how many days until a person's birthday.	1	2	3	4	5
6.	Taking a maths exam.	1	2	3	4	5
7.	Being asked to calculate £9.36 divided by four in front of several people.	1	2	3	4	5
8.	Being given a telephone number and having to remember it.	1	2	3	4	5
9.	Reading the word "algebra".	1	2	3	4	5
10.	Calculating a series of multiplication problems on paper.	1	2	3	4	5
11.	Working out how much time you have left before you set off to work or place of study.	1	2	3	4	5
12.	Listening to someone talk about maths.	1	2	3	4	5
13.	Working out how much change a cashier should have given you in a shop after buying several items.	1	2	3	4	5
14.	Deciding how much each person should give you after you buy an object that you are all sharing the cost of.	1	2	3	4	5
15.	Reading a maths textbook.	1	2	3	4	5
16.	Watching someone work out an algebra problem.	1	2	3	4	5
17.	Sitting in a maths class.	1	2	3	4	5
18.	Being given a surprise maths test in a class.	1	2	3	4	5
19.	Being asked to memorise a multiplication table.	1	2	3	4	5
20.	Watching a teacher/lecturer write equations on the board.	1	2	3	4	5
21.	Being asked to calculate three fifths as a percentage.	1	2	3	4	5
22.	Working out how much your shopping bill comes to.	1	2	3	4	5
23.	Being asked a maths question by a teacher in front of a class.	1	2	3	4	5