

Development and preliminary validation of mathematics anxiety symptoms in adolescence

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ABSTRACT: The study sought to develop a new scale to measure the symptoms of mathematics anxiety in male and female at adolescence in India. The main research question is whether we can explore a special structure for symptoms of Mathematics Anxiety in adolescence. By using all of the aspects of Mathematics anxiety a primarily questionnaire with 53 item was developed and piloted based on a sample of 450 students. Analyzing the data extracted three factors of different aspects of mathematics anxiety symptoms. Psychometric data of reliability and validity has shown significant results and is improved remarkably that this instrument can be considered as a suitable criterion for prospective clinical interventions.

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Introduction:

The construct of ‘mathematics anxiety’ has received considerable attention among researchers and mathematics educators in recent years (Newstead, 1998). Hembree (1990) found that 22.9 percent of the adolescence had a moderate to high need to be helped with math anxiety. Many students who suffer from mathematics anxiety have little confidence in their ability to do mathematics and tend to take the minimum numbers of required mathematics course led to greatly limitation in their career choice options (Garry, 2005). Mathematics anxiety is an outcome of low self-esteem and fear of failure. It causes problems for processing the next oncoming information as well as using the previously learned information for problem solving. Such students tend to avoid mathematics whenever or wherever possible (Daane and Tina, 1986).

The psychological literature provides a number of conceptualization of Mathematics anxiety. Richardson and Suinn (1972) defined mathematics anxiety in terms of its “debilitating effect” on mathematical performance. They observed that the feeling of tension and anxiety interfere with manipulation and solving of mathematical problems in a wide variety of ordinary life and academic situations. Norwood (1994) describes math’s anxiety as the results of different factors including the inability to handle frustration, excessive school absences, poor self concept - teacher attitudes towards math’s and emphasis on learning math’s through drill without understanding. Duffin (1989), states that mathematics anxiety is a combination of physical, cognitive and psycho -

behavioral components.

From a behavior analytic perspective, math anxiety can be viewed as including both overt and covert behavior (i.e., observable and unobservable respectively). For instance, excessive psychomotor activity, time spent off-task, avoidance, and distressed verbalizations are examples of possible overt math anxious behaviors. Examples of math anxious covert behaviors are physiological reactions, thoughts, and emotional responses (Rabalais, 1998).

Dossel, (1993) identified several factors leading to the creation of math’s anxiety: which are outlined as follows:

A, Personality factors (the belief that success cannot be attributed to effort– feelings associated with lack of control).

B, Pressure of perceived authority figures (parents, teachers).

C, Time pressure (to answer quickly and verbally).

D, Effect of public failure (asking to perform in front of a class).

E, Right – wrong dichotomy (the teacher’s attention should be directed towards effort rather than achievement).

The beginnings of anxiety can often be traced to negative classroom experiences and the teaching of mathematics (Stodolsky, 1985; Clute, (1984). It is considered critical to examine classroom practice and establish whether the roots of math’s anxiety may be in instructional methods and in the quality of math’s teaching in elementary school or not (Newstead, 1998).

In spite of more than three decades of active study of mathematics anxiety in U.S and west, there is little study in the other countries. The factors that has found in this study can help us to understand the real sense of mathematics anxiety symptoms in students. Accordingly, three questions can be propounded:

1. Does we can explore a new structure for symptoms of Mathematics Anxiety in adolescence?
2. Does the symptoms of Mathematics Anxiety generated to reflect previous identified domains factors?

3. Does the symptoms of Mathematics Anxiety evidence adequate measured on reliable and valid scales?

Methodology:

The validation sample was 450 objects, comprising 3 groups of schools (local state government, Central Board of Secondary Education (CBSE), New Delhi (India) and Indian Council of Secondary Education (ICSE), New Delhi (India) that showed in table 1.

Table 1. Distribution of Sample.

Grade Levels	8 th Class						9 th class						10 th Class						Total
	State		CBSE		ICSE		State		CBSE		ICSE		State		CBSE		ICSE		
Number of schools	6						6						6						6
Type of schools	State		CBSE		ICSE		State		CBSE		ICSE		State		CBSE		ICSE		6
class	2		2		2		2		2		2		2		2		2		18
Number of students	50		50		50		50		50		50		50		50		50		450
Sex	M	F	M	F	M	F		M	F	M	F	M	F		M	F	M	F	450
Distribution	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	

(KEY: State: Syllabus of State Governments; CBSE: Syllabus of Central Board of Secondary Education; ICSE: Syllabus of Indian Council of Secondary Education; M: Male; F: Female)

Procedure:

The study is carried out in four interconnected but separate phases. Planning, construction, quantitative evaluation and psychometric properties are four development phases of this study:

Phase 1: “Planning” [Conducting a literature review, pilot study to tryout different potential items and two interviews with students]

Phase 2: “Construction” [Determining and defined domains, Generating item pool and Conducting expert reviews of all items for content and agreeability validation.]

Phase 3: “Quantitative Evaluation” [Conducting an item pool on the students, Reducing item pool to only the most valid and reliable items.]

Phase 4: “Psychometric Properties” [Assessing the validity (content validity and criterion validity) and reliability (internal consistency)]

The data analysis focused around the assessment of the structural (underlying factors or subscales) and psychometric (reliability and validity) properties of the scale.

RESULTS & DISCUSSION

3.1.1 Developing item pool questionnaire:

By using of all of the symptoms of mathematics anxiety, an item pool with 83 items developed. These 83 items were corrected by experts and interviewers in four interviews with students and mathematics teachers and at last 30 item removed from the main questionnaire. These comprised 53 items administered on the students and were asked to respond using a 3- point likert – type scale .The scale ranged from agrees, don’t know and disagree. This primary item pool has shown in appendix 1.

Factor extraction:

The 53 items of the instrument mathematics anxiety symptoms were administered to the 450 students and their scores subjected to factor analysis using principal component and varimax rotation to verify the factorial composition of the instrument as well as define the common measure. Kaiser-Meyer-Olkin Measure of Sampling Adequacy (.886) and Bartlett’s Test of Sphericity (5989.4), has shown that the properties of sample are appropriate for factor analysis. Three factors were extracted. The number of factors was determined by contrasting the results of a parallel analysis with an analysis of the scree plot. The extracted factors are shown in appendix 2.

Factor interpretation:

Results of the factor analysis indicate that out of the 53 items of the MASQ subjected to factor analysis with varimax rotation; only 25 items attained the minimum loading of 0.50 and was accepted as valid.

As it is shown, factor 1 is comprised of 12 items associated with physiological and behaviors matters (physiological factor). Factor 2 comprises 6

items associated with social matters (social symptoms) and factor 3 contains 7 items associated with psychological and emotional matters (Cognitive – emotive symptoms). Together, these three factors accounted for 68.26 percent of the variance. Their quasi-orthogonal nature suggests that each factor is measuring something unique. It has shown in table 2.

Table 2. Subscale Means, Standard Deviations, and Cronbach Alpha Coefficients of MASQ

N	factor	Number of items	M	SD
1	Physiological symptoms	12	.22	.916
2	Social symptoms	6	2.03	.897
3	Cognitive – emotive symptoms	7	1.96	.832

Psychometric properties:

The Indices of internal consistency associated with each sub-scale has shown that all of three indices exceed .70; which is often regarded as the benchmark for claiming that a scale is sufficiently reliable to be used in applied settings. Moreover, concurrent validity has showed significant relationship between total score on each subscale of the mathematics anxiety symptoms and the total score on academic performance. As it is expected, all subscales on the mathematics anxiety symptoms were negatively correlated with academic performance.

Table 3. Inter correlations between subscales of MASQ and Academic performance.

N	Sub scales	1	2	3
1	Physiological symptoms	-		
2	Social symptoms	.26*	-	
3	Cognitive – emotive symptoms	.32**	.55**	-
4	Academic performance	-.34**	-.19*	-.49**

*Note. N = 450. All of this correlation is significant at. * p < .05 and ** p < .01.*

3.2 Conclusion

The purpose of this study was to investigate the nature of mathematics anxiety and developing an instrument to assessing mathematics anxiety symptoms for use specifically with adolescence.

Analysis of data has showed that there is a support for the hypothesis with three factors in mathematics anxiety. In this study we found three factors that support the number of previous studies but there are differences in kind of components. Factor 1(physiological factor) associated with physiological and behaviors matters (feel of chest pain and feel to ringing some sounds in ears) and some of this items overlapped with other studies and

confirmed them (Mitchel, 1987). In Factor2 (Social symptoms), factor analysis on data discovered that they experience a kind of Mathematics related to social situations. Some of these items is special for Indian students (feel of foolishness and feel of shame). According to cultural differences this items has a various forms that Dossel(1993), found the effect of public failures is a main factor in Mathematics anxiety. Factor 3(Cognitive – emotive symptoms), comprised of various items that reflex the psychological satiations (get irritated and become sad) and in the other studies showed in different forms. The research is also concurrent with Mitchel’s (1987) finding that found two factors for

Mathematics anxiety (cognitive and psycho behavioral components), moreover it is agreeing with Wigfield & Meece (1988); and Dossel (1993) that suggested Cognitive – emotive and Personality factors in Mathematics anxiety .

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