

Divided minds: Adults' anxiety towards mathematics

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Abstract

This presentation reports on the findings of a research concerning anxiety towards doing mathematics experienced by adults who have returned at school, assuming that negative emotions and particularly mathematics anxiety drive persons to avoid learning and using mathematics and thus to self-exclusion from participating in many aspects of social, cultural and civic life. As the evidence of this research indicates a considerable number of adults reports no anxiety when carrying out number manipulations or operations in everyday life mathematical activities, although a remarkable variation is found according to the situation and the tasks involved. On the other hand a high level of anxiety has been reported when the adults are thinking or are carrying out activities related to school mathematics. As a main conclusion may be claimed that mathematics anxiety is “taught” by school mathematics practice and “learned” by students and finally becomes a constituent aspect of their “mathematical self-determination”.

1. Background of the study

This presentation is based on the findings of a research into negative emotions and anxiety towards mathematics reported by adults who were studying at a Greek Second Chance School, at the time of this research. These students aged between 18 and 30 have not completed the 10 year compulsory education cycle and therefore they lack both the basic knowledge and the specific competencies to fully benefit from available

opportunities in training, labour, social and cultural life, thus experiencing a situation or are faced by an immediate threat of social and/or cultural exclusion as well as of civic marginalization (Eurydice, 2010).

The research aimed at tracing adults' anxiety towards mathematics as a school subject and as an essential component of everyday life activities, assuming that persons experiencing mathematics anxiety are avoiding learning and using mathematics and thus are gradually excluded, subjectively or objectively, from participating in many aspects of social, cultural and civic life.

Anxiety is a psychological and physiological state of a person characterized by somatic, emotional, cognitive, and behavioral components. Mathematics anxiety, in particular, has been studied as a topic in mathematics education research for more than 30 years and it has been defined and described in the relevant literature in many and differing terms. For instance, Richardson and Suinn (1972, p. 551) described mathematics anxiety as "*involving feelings of terror and anxiety that interfere with manipulation of numbers and the solving of mathematics problems in a wide variety of situations*", Tobias & Weissbrod (1980, p. 65) defined mathematics anxiety as "*the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem*" and Spicer (2004, p. 1) stated that mathematics anxiety is "*an emotion that blocks a person's reasoning ability when confronted with a mathematical situation*". At the same time, many scholars have correlated or even identified mathematics anxiety with mathophobia, "*an irrational and impeditive dread of mathematics*" (Lazarus, 1974, p.16).

Defined in the one or the other way, mathematics anxiety is reflecting a vicious cycle of mathematics avoidance that leads to educational and societal mathophobes" (Williams, 1988, p.96).

Most of the researchers in the field are in agreement that we may distinguish two dimensions of mathematics anxiety on the basis of its context. Mathematics anxiety related to mathematical / numerical activities of everyday life situations and mathematics anxiety related to school mathematics, courses, lessons, textbooks, tasks, tests and examinations. Rounds and Hendel (1980, p. 142) describe this distinction as two factors of mathematics anxiety. The first, named "mathematics course or mathematics test anxiety", reflects apprehension about mathematics courses as well as about anticipating, taking and receiving the results of school mathematics tests and the second factor, named "numerical anxiety", refers to anxiety

generated by everyday concrete situations requiring some form of number manipulation, use of elementary arithmetic skills in practical situations as well as to practical skills necessary for making money decisions.

2. Research methodology

In the research reported in this presentation they have been participated 191 adult students from 3 Second Chance Schools at Athens and Thessaloniki. A questionnaire extracting items from Richardson-Suinn Mathematics Anxiety Rating Scale (MARS) as revised for adolescents (Suinn & Edwards, 1982) has been developed and employed for our data collection.

The Mathematics Anxiety Rating Scale for Adolescents (MARS-A) includes 98 items which are brief descriptions of behavioural situations, as for instance “thinking that a mathematics lesson is forthcoming”, “solving a mathematics problem in the classroom”, “adding two three-digit numbers while someone looks over your shoulder” or “checking your bill in a restaurant”, in response to which people are expected to indicate different levels of anxiety from “not at all” to “very much” anxious. According to its inventors, since different kinds of anxiety lead to different effects on intellectual performance the MARS-A scale aims to be situational-specific and trace the particular anxiety producing factors. In Evans’ view the MARS scale is the more appropriate indicator to be used for the study of the variation in numerate performance and anxiety across contexts (Evans, 2000).

As most of the researchers in the field are in agreement that we may distinguish mathematics anxiety related to mathematical / numerical activities of everyday life situations and mathematics anxiety related to school mathematics activities we have included in our questionnaire questions referring to these two contexts. Each question has been phrased and posed in two variations. Questions referring to numerical activities carried out in a private situation, e.g. calculate a sale price and questions referring to numerical activities carried out in a public situation, where the person is under observation by others, e.g. checking a bill in a restaurant.

After all, our questionnaire included 28 questions aimed at tracing adults’ anxiety towards mathematics plus demographic questions, as are sex, age, family status, employment etc.

It has to be emphasised, however, that tracing mathematics anxiety and probing its sources on the basis of adult students’ self-reports as well as concluding on the basis of quantitative data drawn from these self-reports

have to be considered from a critical standpoint. On the other hand, the lack of research into adults' mathematics anxiety in Greek literature credits this research with a rather pioneering value.

3. Selected findings

In the following they are presented and briefly commented two sets of findings concerning mathematical / numerical activities and tasks carried out respectively in specific everyday life and school mathematics contexts.

- (a) Considerable percentages of adults ranging from 20% to 70% acknowledge that they felt anxious when involved in particular everyday life numerical activities in various contexts. For instance, half of the participants in this research report that they felt anxious when they are obliged to read and comprehend numerical data, as those contained in a home electricity bill and significant percentages of adults feel anxiety when having to carry out number operations, e.g. finding the balance of a payment (39%) or calculate a sale price (40%). Significant, as well, are the percentages of adults reporting anxiety when they have to estimate or compare numerical data or results, e.g. two different priced holiday trips (36%) or home expenses (56%). On the other hand, adults in high percentages report that they feel no anxiety when carrying out calculations and numerical estimations in playing games of chance (70%), shopping calculations (80%), checking bills (70%) or work out someone's age (74%). It seems that for adults the numerical manipulations and the number operations acquire various meanings depending on the context in relation to their significance for their personal or family decisions.
- (b) The participants in this research report a considerable anxiety when thinking or carrying out activities related to school mathematics, which according to the evidence is much stronger than - and in statistical terms significantly different from - the anxiety felt when involved in everyday life numerical activities. It is characteristic the percentage of adults which reports that they feel anxiety even reading the word "mathematics" (36%). The solution of problems in mathematics classrooms seems to be an anxiety producing activity in a rather high percentage (60%). It is characteristic that even listening to another person explaining the solution of a mathematics problem is reported as an anxious event by the participants of this research (43%), and even more an anxious activity is considered the explaining of how a mathematics problem has been solved (56%), especially in cases where

there the adults feel uncertain about its solution (62%). Furthermore, the mathematics classroom per se seems to be a source of anxiety for a significant number of adults. The waiting for the mathematics teacher to arrive (25%), the attending a mathematics lesson (33%) or the thinking of a forthcoming one (33%) are reported as anxious situations.

Finally, according to the answers offered by the adults who participated in this research their mathematics anxiety is not found to be significantly differentiated when the numerical activities are taking place in a “private” or in a “public” context. Likewise, no significant differences are found according to the demographic characteristics of the participants.

4. Main Conclusions

As the evidence of this research indicates a considerable number of adults reports that they feel no anxiety carrying out number manipulations or operations in everyday life numerical activities, despite a remarkable variation according to the situation and the tasks involved.

On the other hand a state of personal anxiety has been reported when the adults are thinking or are carrying out activities related to school mathematics. Anxiety which is much stronger in problem solving situations, mainly related to school evaluation tests and exams.

This is endorsing the claim that mathematics anxiety is situationally specific and not transsituational (Rounds & Hendel, 1980), therefore it is not transferred from the one situation to the other. Thus, the non-anxious feelings of coping with everyday life mathematics may be quite difficult to be transferred to mathematics classroom situations simply by introducing imitations of everyday life situations to mathematics lessons. So from this psychological point of view, the contribution of real life situations introduced into school mathematics is questionable.

The reported by the participants of this research as sources of their anxiety were mainly associated to their difficulties in comprehending mathematics texts, their negative experiences from school mathematics, their uncertainty of answering mathematical or numerical questions and their fear of disapproval by others, their feelings of a deficiency concerning their mathematics knowledge and skills and their beliefs about the useless of school mathematics in out of school contexts.

These factors claimed by adult students for their mathematics anxiety confirms a rather negative effect of school: the mathematics anxiety is “taught” by school and “learned” by students and finally becomes a constituent aspect of their “mathematical self-determination”. This effect

may not be exclusively attributed to a sole component of school mathematics education but it seems a product of an established pedagogy of mathematics as a social practice.

An interpretation of this process grounded on the cultural practice theory may be based on the following idea. Assuming that knowledge is situated within particular contexts then particular people have difficulties with school mathematics as a result of a discontinuity between schooling and other cultural contexts in their lives (Brown, Collins & Duguid, 1989, Lave, 1988). In accordance, these people develop negative thoughts, emotions and behaviours towards mathematics considering it exclusively as a school subject matter. As a consequence, they exclude themselves initially from school mathematics and finally from school *and* mathematics. The incorporation of inclusive practices in mathematics classrooms which recognise a variety of mathematical ideas, understandings and vocabularies widespread in everyday life activities of people is a demand from the standpoint of a democratic mathematics education. Such equitable practices allow all students to recognize and participate in career opportunities and preparations offered by school and at the same time offer them chances for intellectual exploration and development within their own understanding of mathematics and everyday life.

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