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Strategies to prevent anxiety towards mathematics

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Abstract

Society nowadays refers to the utility of mathematics as a powerful and concise mean of communication with which one can represent, explain and predict, while its study contributes to the development of logical thinking, spatial perception and exactitude; although the magnitude of this process depends on the way it is taught. In this sense, there are multiple factors that condition maths education, although lately the affective field has acquired special relevance considering that when it comes to learning, attitudes and anxiety are a much worse obstacle than any of the supposed deficiencies in the curriculums of our schools. In the case of mathematics, the consequences are worse than in any other subject. The aim of this research is to find out some conditioning factors that cause anxiety and to develop guidelines for action to prevent it. It is concluded that appropriate educational intervention strategies can remove the anxiety towards Mathematics.

Keywords: Mathematics; anxiety; strategies

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1. Background

There are multiple factors that condition maths education, although lately the affective field has acquired special relevance considering that when it comes to learning, attitudes and anxiety are a much worse obstacle than any of the supposed deficiencies in the curriculums of our schools. In fact, once the illness is diagnosed, there is no easy cure. That is why teachers should reflect on what Biggs (1959) already affirmed long ago: defeating mathematical anxiety is fundamental, but prevention towards it is even more.

Nevertheless, although infantile anxiety has been studied from a clinical perspective, it has serious limitations. The main one is the little consideration towards the intraschool factors as determinants of infantile or youth anxiety. In fact, both biological and behavioural models have paid attention to familiar factors (such as sociofamiliar climate or separations) and the own (temperament, past traumatic experiences), but have forgotten such important factors as the scholar learning and skills that the kid lacks. Even the applied cognitive-behavioural approach that has been developed in the 80s and, within that approach, some specific models like Kendall and Ingram's (1987), may not be enough in this sense if the cognitive processes taken into consideration are not related to scholar factors.

In the case of mathematics, the consequences are worse than in any other subject. An anxious child worries too much about what they are doing, as well as about the effects that a possible failure will have and they even have doubts about their own capacity.

The cognitive level can block logical thinking, affect the accomplishment of tasks provoke failure in mathematics despise intellectual capacity, as fear usually controls the processes of conceptual thinking. Anxiety towards mathematics can therefore keep the individual from being conscious of their potential in this subject. It also interferes with memory and that can be confused with the fact that students under pressure tend to memorize things instead of understanding them (Puteh, 2002).

Anxiety can lead to a vicious circle of cause and effect. Assuming failure can make the student get used to it, reaffirming convictions, while irrational fear paralyzes a person's thinking.

2. Object of Research

Mathematics education is considered a fundamental tool nowadays, which is why acquiring basic mathematical skills and understanding certain concepts is indispensable for an effective functioning of contemporary society. However, many teachers are worried about the inappropriate performance of their students, and the aversion towards the subject. A possible explanation about mathematical anxiety (Carmona, 2004) is that in most of cases it comes from an early age, and grows as school years go by.

It is important to remark that this is what motivates us, besides the fact that anxiety derived or sheltered by academic problems is initially the one that is easier to prevent as well as the most worthy of prevention. Diversity and emotional variety that both teachers and students can experiment will have a decisive influence on physical and/or emotional health of both of them. That is why in this study we contribute with guidelines that in our opinion should be used in the process of prevention of mathematical anxiety.

We find the provided ideas relevant when it comes to the training of both teachers and students. On one hand, they can be useful for the teachers in the instruction, methodology to use and strategies teaching. On the other hand, in the emotional and affective field, it would help to improve the rejects that students feel about mathematics, about math teachers, about the learning situation in which they develop and in general towards the school, towards other people or towards themselves.

3. Evidence sources

Many are the alterations that could be encompassed under infantile and youth anxiety: from specific phobias to the most diffused shapes of anxiety, and from those directly related to school to those that have nothing to do with it (Bornas, 1996 and Rosenfeld y Rosenfeld, 2008).

In this study we focus on mathematical anxiety associated to what generically we can denominate academic life at school, the concept, its prevalence and evolutionary course, its importance, reflecting on the cognitive processes and the relation between anxiety and success in mathematics. We will end this research with a guideline to prevent it.

Anxiety is the root of many phobia or scholar rejection cases, and the need to prevent it is understood when one thinks of the effects that scholar failure can cause, in the short-term, medium-term and long-term. The term anxiety is commonly used to describe an unpleasant emotional state or condition, and it is defined by subjective feelings of tension, apprehension, preoccupation and activation of the nervous system (Gutierrez Calvo, 1996). This state of anxiety is specific in time and place, and it comes up when an individual perceives a situation as something potentially harmful or dangerous.

The second edition of Diagnostic and Statistical Manual of Mental Disorders (DSM-II, 1968) describes a pathological state denominated "anxiety neurosis", which is defined by chronic tension, excessive preoccupation, frequent headaches or recurrent anxiety crisis. The appearance of DMS-III in 1980 becomes a milestone in the diagnosis of infantile and youth anxiety, recognizing that it cannot be included in within anxiety typical of adult ages (Klein y Last, 1989). DSM-III-R (1987) supports the same basic structure and DSM-IV (1994), despite the introduced changes, does not include scholar phobia that, according to Fauvel (1991), constitutes the most meaningful change at those ages. Among the scholar phobias, mathematical anxiety is the one that generates more feelings of uneasiness, fear, insecurity and confusion, appearing as negative expressions and connotations (Gil, Blanco y Guerrer, 2005), making many students conceive mathematics as a complex knowledge.

On his behalf, Truttschel (2002) states that there is an emotional factor in mathematics that seems to be pathological in intensity and at the same time specific for this subject. A factor that keeps people from connecting to mathematics the way they would like to, turning mathematical capacity into something tremendously difficult, almost impossible. The factors that explain academic failure the best are, on one side, the lack of knowledge and cognitive abilities and on the other side, the insufficient motivation, interest and positive affections.

We can consider mathematical anxiety not only an aversion towards the subject, but also as something with more devastating effects: irrational and illogical fear towards mathematics, as well as panic, impotence, paralysis and mental disorganization that emerges in some people when they are asked to solve a math problem (Onwuegbuzie, 2003).

4. Main argument

Analysis and reflection about the way students learn, about its practice and the context in which they develop is the mechanism through which the teacher can be conscious and face the diverse problems that come up to the pupil. In this regard, the negative answers to a curriculum that the student cannot dominate are moved from anxiety, fear and frustration after several failures to discourage and indifference (Mato, 2014).

In a cognitive level, it can block logical thinking (Hannula, 2002), affect the realization of tasks and provoke failure, as fear usually controls the processes of conceptual thinking. It also interferes with memory, as students under pressure tend to memorize instead of understanding; it alters the attention (Ashcraft, 2002) and keeps the student from being conscious of their potential in this subject. Also, anxiety can be cause the student to avoid future courses and studies related to the

subject, which results in a limited election of college studies (Hembree, 1990), a deficient ability in the realization of exams, negative feelings of guilt and shame (Rosenfeld y Rosenfeld, 2008) and a decrease of success in their professional life.

Many investigations point that negative attitudes increase during the first courses of Secondary Education (Broc Caveró, 2006). For his part, Kazelskis y Reeves (2002), and Hannula (2002), claim that the relation between attitudes towards mathematics and mathematical success is meaningful since halfway of Primary School. There seems to be a negative relation between mathematical anxiety and success in it. These correlations have been documented in different studies in adults and Secondary students (Richardson y Suinn, 1973 y Mato, Espineira y Chao, 2014).

Something that every researcher agrees with is that the final result of mathematics does not only depend on intellectual factors, but is also determined by perspectives and experiences of students, and by their own vision of themselves as mathematics students. In other words, mathematical results depend greatly on affective factors (Evans y Wedege, 2004; Broc Caveró, 2006; Bursal y Paznokas, 2006). The following are some of the guidelines to prevent mathematical anxiety.

- Dissipate the myth of the mathematical mind: to convince them that this course is not more difficult than any others, that it is apt for everyone and that they are not bad at it just because they make mistakes.
- Decrease the fear of failure, as if the risks and consequences of failure are avoided, positive attitudes increase.
- Make mathematics fun in a flexible, informal, recreational environment, in which math results interesting and useful, and helps persevere in the search of solutions of strategies and favours the integration and incorporation to the mathematical activity of those students who have a low scholar performance.
- Make sure that every concept is understood before moving forward. Many students feel frustrated when they are not able to understand or to follow their group's pace and they get unmotivated when nobody approaches to them to see what is wrong.
- Help students explore their anxieties towards mathematics through the discussion of positive and negative experiences that enrich classes and favour the student's trust.
- Manipulation: working with mathematics equals creating, investigating and experimenting.
- Motivation through a kind of learning that connects with daily life aspects and shows to be useful.
- Methodologies that favour the learning.
- Diffusion of mathematical culture: poetry, painting, architecture, music, press, photography, etc., as mathematics are presents in every life aspect.
- Use computers as an important supporting instrument.
- Eliminate the pressure that comes from performing tasks on a blackboard with a time limit by not making students who feel uncomfortable about it do it.
- Provide positive and successful experiences through activities that we know beforehand a student can accomplish.
- Work in groups.
- Create a positive atmosphere, in which students feel safe to make questions and assume risks without fearing to be criticized.

- Use diverse and concrete examples.
- Provide challenges, but counting with the teacher's support.
- Encourage them to ask questions.
- Convince them that making mistakes is important in the learning process.
- Recognize that different methods and even different answers are possible – there are many ways to find the same solution.
- Think about the how and why of a problem, seeing what students think and how they think helps create a positive learning atmosphere and they learn to reason and verbalize their mathematical thinking.
- Avoid expressions that discourage them such as, “This is the best way to do it”. It is more beneficial to say, “This is another way to do it”.
- Adapt the teaching to the knowledge levels.
- Use other evaluation alternatives: oral questions, observation, demonstrations, procedures.

5. Conclusions

Mathematics has been a nightmare for many generations of students. However, the mathematics teacher can be a transistor of not only cognitive tools but of positive experiences and success motivation. They can help the student acquire self-confidence and if they get it, they will have the guarantee of having reached big goals in the educative subject: the harmonic development of the student's personality, their happiness and the adaptation to every kind of environment (familiar, scholar, labor, social).

In conclusion, mathematical anxiety is something real and most of it happens in the classroom. That being said, positive experiences eliminate pressure; in a flexible environment students are able to develop positive attitudes towards the subject; if they improve their abilities, they understand the concepts more enthusiastically; if the fear is taken away, they enjoy learning and want to work with mathematics.

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