

## PAPER PRESENTATION

Validation of CIE-TMa: an instrument of measure of the emotional impact of mathematics learning

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The area of Mathematics is one of the most linked to the school failure (Bermejo, Lago, Rodríguez and Péérez, 2000) and there are a lot of students who relate it with inappropriate attitudes and especially with emotional shocks and refuse to this kind of learning (Gómez-Chacôn, 2000). In this paper we present the design and validation of the questionnaire CIE-TMa (Cuestionario sobre Impacto Emocional y Tareas Matemáticas – Emotional impact and mathematics tasks questionnaire), whose aim is to highlight the emotional impact (resilience versus mental block) to which Secondary students face when they tackle tasks of mathematic learning. The data obtained from the initial pilot questionnaire was used as a base for the CIE-TMa elaboration, which finally has been validated by a sample of 342 participants. The results indicate that the CIE-TMa possesses enough psychometrical properties and it can be used to measure the three factors which can influence in the success perception to the mathematic tasks in an adequate way: self-confidence, resilience capacity against the perception of failure and emotional block.

**Introduction** In the last few years, with the aim of measuring the students' achievement, several public organisms have carried out certain studies which have ranked and classified the different countries on the basis of the level of development of the basic competencies. The most utilized as a reference for comparing the learning quality is the Programme for International Student Assessment, PISA (2000; 2003; 2006), set up in 1997 by the OECD for measuring the level of development of some basic competencies in which the capability of dealing with mathematics is included. When developing these competencies thorough learning tasks, and in particular the mathematics competency, the attitude and interest of the students occupy an important position according to the experience of teachers of this area (Gil, Rico y Fernández, 2002). The concept that the students have about themselves as trainees in mathematics appears to be one of the variables that has influence on the self-confidence when facing the task. Such a variable has an essential role at the time of achieving positive academic results (McLeod, 1992). But, particularly, the emotional modulation what each student do during the learning process which is specially linked with the academic self-esteem. Claxton (1999) stated the need for the trainees to maintain for learning an adequate level of confidence and, with the goal of explaining the emotional participation in the learning process, established a cognitive-behavioral model which considers that emotions may play a stimulating and positive role or, on the contrary, turn into barriers for achieving an effective learning. For such purpose, we use the personal tools that he classified in three great groups: reflection, resources and resilience. The purpose of our study has been the implementation of resilience micro procedures against the mental block when tackling the school task of learning mathematics, the designing and validation of an instrument for detecting the emotional impact that said tasks have on the students, considering the influence in the impact of the self-confidence of the students, the resilience capacity and the emotional block that is provoked.

**Methodology** On the basis of the theories stated by Claxton (1999), we elaborated a 20 items questionnaire ". The initial hypothesis was to consider the existence of a factorial and empiric relationship that supports the virtuality of the referred theories in relation to the mathematic learning. Once the instrument was designed, we developed a pilot study with a sample of 95 students among six groups of Second Grade of ESO (14 year-old). A

factorial analysis was performed with data obtained, which showed the existence of three factors but also some series of items which were not correlated to any of them. After eliminating and reordering the items, the definitive version of the CIE-TMa Questionnaire (Emotional impact and mathematics tasks questionnaire, Madera, Ortega y Del Rey, 2009), composed of 13 items, was elaborated. The questionnaire was answered by 342 students of ESO following the standards of voluntarily, anonymity and independence. Results When performing the factorial analysis we checked that, in effect, the use of this analysis was feasible (Bartlett Sphericity Test =1161.095;  $p=.000$ ). The KMO coefficient of Kaiser-Meyer-Olkin offered a value of .811. The variation percentage was of 55.66% and the Cronbach  $\alpha$  for each of the three resulting factors: .833 for block, .636 for resilience and .668 for self-confidence. In the oral presentation the items composing all of them will be described.

**Conclusions** The exploratory study suggests that the emotional modulation that students do when facing mathematics tasks may be regarded as tridimensional. The exploratory factorial analysis showed that a structure of three factors (selfconfidence, resilience and mental block) is adequate, explaining an acceptable total variation percentage for measuring emotional impact and the way to deal with it when tackling school tasks related to the learning of mathematics. In addition, the scale has a good internal consistence. The results of this study indicate that the CIE-TMa has good psychometric properties, contrasted by the KMO coefficient and the Cronbach  $\alpha$ . Therefore, it provides us with an acceptable measure of the different factors that have influence when facing said tasks. In addition, it shows a good performance with the sample of students utilized, which increase the possibilities for its utilization with more representative samples. On the other hand, given its simplicity and ease to be used by the teachers of mathematics and by other educational agents as school counselors, the CIE-TMa seems to be an useful instrument that may, in case used as a diagnosis instrument, anticipate and prevent many of those little and big problems related to motivation and attitudes towards learning one of the most relevant school domains: the mathematics competency.

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