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Self-concept, motivation, expectations, and socioeconomic level as predictors of academic performance in mathematics

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ABSTRACT

The objective of the present work is the study of the relationship between academic performance in two academic disciplines (Mathematics and Sciences) and three variables of an individual nature (Academic Self-Concept, Motivation, and Academic Expectations). In addition, the possible modulating effects of the socioeconomic level of the students were also taken into account. A sample of 7729 students in the second grade of Compulsory Secondary Education in Spain was used. The mean age was 13.78, – SD = .82 –, 52.8% were males. The results allow us to confirm that the variables analyzed present a high and statistically significant correlation with academic performance. The canonical correlation among those four variables and two measures of academic performance is .56. In the structural equations model proposed, 72% of the variance in academic performance is explained. No relevant differences were obtained as a function of student gender.

1. Introduction

Research on the determinants of academic performance can be approached mainly from two perspectives, contextual and personal (Lee & Shute, 2010). From the contextual or sociological perspective, research has basically focused on studying the effect that socioeconomic level has on students' academic performance. After conducting a meta-analysis, Sirin (2005) concludes that there is a medium–high relationship between socioeconomic level and academic performance. However, this author would like to clarify that this relationship is moderated by aspects such as the information source (parents, students or second-hand sources) or the type of measurement performed to assess both socioeconomic level (education, occupation, income, neighborhood, housing, etc.) and academic performance (in general, mathematics, science, etc.). At the same time, the relationship between socioeconomic level and academic performance depends on the level, status and location of the school. The 2009 PISA (*Programme for International Student Assessment*) results indicate a positive association between socioeconomic index and the competences results in all OECD (*Organization for Economic Cooperation and Development*) member countries. In practice, this means a confirmation of this relationship in 34 countries, which represent approximately 80% of the world PIB (OECD, 2010). The implications that can be drawn from these results imply solutions at a social level, and therefore, these relate more to social equity policies than to the individuals themselves.

From a personal perspective, research studies that have attempted to find a connection between personal characteristics and academic performance are organized around two main research lines, one related to cognitive abilities, and another focused on variables of an orectic character, such as attitudes and personality. Within the cognitive perspective, intelligence has become, with almost all certainty, the variable that has played a hegemonic role for the longest time as the great predictor of academic performance (Chamorro-Premuzic, 2007). Nevertheless, despite its clear relationship with performance, it rarely explains about 50% of academic performance (Chamorro-Premuzic & Furnham, 2004; O'Connor & Paunonen, 2007). This implies that more than 50% of the variance is being ignored from a strictly cognitive perspective and could be explained through other variables. The search for other variables related to academic performance has been focused especially on those of an orectic type. Thus, for example, Self-Concept has been shown to be a good predictor of academic performance both in secondary education students (Broc, 2000; Martín-Antón, Carbonero, & Román, 2012) and in university students (Choi, 2005; Gargallo, Garfella, Sánchez, Ros, & Serra, 2009; Guay, Ratelle, Roy, & Litalien, 2010; Huang, 2011), and it can explain differences in academic performance among children with and without learning difficulties (González-Pienda, Núñez, González-Pumariega, Álvarez, & Roces, 2000). Other variables that usually appear connected to academic performance are Motivation (Hornstra, van der Veen, Peetsma, & Volman, 2013; Núñez et al., 2011; Rosário et al., 2012; Steinmayr, Dinger, & Spinath, 2012; Steinmayr & Spinath, 2009), self-efficacy (Beghetto & Baxter, 2012; Sawtelle, Brewe, & Kramer, 2012; Zuffiano et al., 2013), Self-Concept (Chen, Yeh, Hwang, & Lin, 2013; Huang, 2011), or Academic Expectations (Lee, Hill, & Hawkins, 2012; Rosário et al., 2012; Valle et al., 2008).

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Nowadays, educational research is focused on how it assesses (Pellegrino, 2012) and how it can improve practice (Mutch-Jones, Puttick, & Minner, 2012). The most promising current approach lies in the creation of comprehensive models; thus, for example, Heaven and Ciarrochi (2012) conclude that intelligence is significantly associated with high academic performance and this effect does not disappear when personality variables are controlled. Along this line, Chamorro-Premuzic and Furnham (2008) propose a structural equation model that explains 40% of the variance in academic performance using the *big five* personality factors and a measure of general intelligence. Similarly, Beghetto and Baxter (2012), propose a path analysis and their results indicate that intellectual risk-taking was positively related to teachers' ratings of science understanding. Results also indicate that students' creative self-efficacy beliefs were positively related to teachers' ratings of math understanding. On their part, Green et al. (2012) propose a longitudinal model of structural equations where self-concept and motivation are significant predictors of attitude toward school, participation in class, doing homework at home, and absenteeism and how all this significantly predicts academic performance.

In contrast, Byrnes and Miller (2007) concluded that socioeconomic status has a direct effect on academic performance, and an indirect effect through other variables that they call opportunity factors (i.e., coursework, teacher variables and school climate) and propensity factors (i.e., aptitude, intelligence, motivation and self-regulation). Chiu and Xihua (2008) conclude that students in families with more resources and fewer competing family members scored higher in mathematics in most countries. Interestingly, these students also scored higher in self-concept and motivation. There is accumulating evidence that even genetic influences on achievement are more pronounced among children living in higher socioeconomic status homes (Lee et al., 2012; Tucker-Drob & Harden, 2012). Therefore, from a psychological point of view, the focus should be on whether the socioeconomic status is a good predictor in itself or because it is associated with emotional variables.

Within this context, in relation to the connection of academic performance with different personality variables of students, in the present research, we will focus on the study of the relationship between two variables of academic performance, Mathematics and Sciences, and three variables of an orectic character: Academic Self-Concept, Motivation and Academic Expectations. The possible effects of the socioeconomic level of the students will also be taken into account.

2. Method

2.1. Participants

The sample was composed of 7729 students enrolled in the second grade of Compulsory Secondary Education (ESO) in the Principality of Asturias, a region situated in northern Spain. Technically, it represents the target population given that the assessment was performed on the whole body of students enrolled in the second grade of Compulsory Secondary Education (ESO) in the 2010–2011 school year in the educational centers of the Principality of Asturias. The participants presented a mean age of 13.78 years and a standard deviation of 0.82; 52% were male and 47.2% female. In addition, 90.6% were Spanish nationals and 9.4% were foreigners. Seventy-nine percent were enrolled in the grade corresponding to their age and 27.1% were behind one or two grades with respect to their age. On the other hand, participants were distributed across a total of 148 educational centers of which 59.4% were public, 37% were state-subsidized, and 2.7% were private.

2.2. Instruments

2.2.1. The academic self-concept scale

Academic self-concept was measured through five items in a scale with a 4-point Likert response format: never or almost never, sometimes, often, and almost always or always. Despite its reduced number of items, it has a high internal consistency ($\alpha = .88$) and is essentially unidimensional, as the first factor explains 68.52% of the item total variance. The items in the Academic Self-Concept Scale are the following: *1*) *I learn the lessons easily*, *2*) *I get good grades*, *3*) *I am a good student*, *4*) *teachers consider me a good student*, *and 5*) *my family considers me a good student*.

2.2.2. The Motivation scale

Motivation was measured through five items in a scale with a 4-point Likert response format: never or almost never, sometimes, often, and almost always or always. Despite its reduced number of items, it has a high internal consistency ($\alpha = .78$) and is essentially unidimensional, given that the first factor obtained explains 53.91% of the total variance of the items. The items that compose the Motivation Scale are: *1*) *I like studying*, *2*) *I work hard to get good grades*, *3*) *in class I make sure I pay attention to the teachers' explanations*, *4*) *I complete my tasks even if they are very hard or take me a long time and 5*) *I am careful that my notebooks and my assignments are neat and tidy*.

2.2.3. The Academic Expectations scale

Student Academic Expectations were assessed by means of a question in which they were asked to consider what type of education they were expecting to achieve: Compulsory Secondary Education (ESO), Post-Compulsory Secondary Education, or University. The option "*I still don't know*" was also provided for those who could not decide between the other previous options. Therefore, a nominal scale of four response categories was used. In order to facilitate its management, it is convenient to modify the scale in such a way that it becomes approximately continuous. To do this, new values were given to the original scale transforming the degree or qualification declared by the student into the number of school years that each title would take. Thus, the students who wished to finish Compulsory Secondary Education would be assigned a 10, those who expected to finish Post-Compulsory Secondary Education a 12 and those who expected to finish University a 15. It was observed that those who did not have clear expectations (vocational indecisiveness) obtained slightly higher scores on the tests compared to those who expected to finish Compulsory Secondary Education; therefore, a value of 11 was assigned in those cases.

2.2.4. Socioeconomic and Cultural Index (SECI)

The Socioeconomic and Cultural Index has been constructed based on the weights estimated in a previous principal components analysis revealing two factors: an economic factor and a cultural factor. The economic index reflects the professional prestige of the mother and father, operationalized in an eight-level scale, as well as the material resources of the home (6 items that include the number of televisions, computers, bathrooms, cars as well as having a landline telephone and dishwasher). On the other hand, the cultural index is composed of the parents' education (years of education) and the number of books in the home (with values of 0, 25, 100, 200, and 500) as well as the family cultural and material resources (i.e., 8 items that determine whether they have a place for studying, a desk, dictionaries, calculator, computer, software, internet and newspapers). In order to ensure the maximum objectivity, we asked the schools to provide the profession and studies of the parents, and the rest of the aspects were assessed with questionnaires completed by the students. The construction of the SECI is conducted by weighing each of these indicators by their factorial weights; for a detailed description, see Peña-Suárez, Fernández-Alonso, and Muñiz (2009).

2.2.5. Academic performance measurement

Academic performance was measured through two tests that assess competences in Mathematics and Sciences. The description of the test content can be found in the Government of the Principality of Asturias (2011). An item bank was created which was purified through a pilot study and following the protocol established by Fernández-Alonso