An Explanatory Model of Academic Achievement based on Aptitudes, Goal Orientations, Self-Concept and Learning Strategies

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As a result of studies examining factors involved in the learning process, various structural models have been developed to explain the direct and indirect effects that occur between the variables in these models. The objective was to evaluate a structural model of cognitive and motivational variables predicting academic achievement, including general intelligence, academic self-concept, goal orientations, effort and learning strategies. The sample comprised of 341 Spanish students in the first year of compulsory secondary education. Different tests and questionnaires were used to evaluate each variable, and Structural Equation Modelling (SEM) was applied to contrast the relationships of the initial model. The model proposed had a satisfactory fit, and all the hypothesised relationships were significant. General intelligence was the variable most able to explain academic achievement. Also important was the direct influence of academic self-concept on achievement, goal orientations and effort, as well as the mediating ability of effort and learning strategies between academic goals and final achievement.
Keywords: academic achievement, self-concept, intelligence, goal orientations, learning strategies.

En el estudio de los factores que intervienen en el proceso de aprendizaje, se han desarrollado distintos modelos estructurales con el fin de ofrecer una explicación de los efectos directos e indirectos que se producen entre el conjunto de variables contempladas en los mismos. El objetivo de este trabajo fue contrastar un modelo estructural de variables cognitivo-motivacionales, predictoras del rendimiento académico, entre las que se incluyeron la inteligencia general, el autoconcepto académico, las orientaciones de meta, el esfuerzo y las estrategias de aprendizaje. La muestra estuvo compuesta por 341 alumnos españoles de primer curso de Educación Secundaria Obligatoria. Se emplearon distintas pruebas y cuestionarios para la evaluación de cada una de las variables y se aplicó SEM para contrastar las relaciones del modelo inicial. El modelo propuesto obtuvo un ajuste satisfactorio, siendo significativas todas relaciones hipotetizadas. La inteligencia general fue la variable con mayor poder explicativo sobre el rendimiento académico. También destacó la influencia directa del autoconcepto académico sobre el rendimiento, las orientaciones de meta y el esfuerzo, así como la capacidad mediadora del esfuerzo y de las estrategias de aprendizaje entre las metas académicas y el rendimiento final.
Palabras clave: rendimiento academic, autoconcepto, inteligencia, orientaciones de meta, estrategias de aprendizaje.

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Studying factors involved in the learning process is one of the most important scientific objectives in educational psychology, and is a fundamental tool for improving curriculum designs and students' academic results (Miñano & Castejón, 2008; Zeegers, 2004).

In this case, given the huge diversity of explanatory factors, the objective was to analyse the influence of certain cognitive and motivational variables that influence the academic achievement of adolescent students. It could be said that intelligence probably constitutes the most frequently studied factor in relation to academic achievement, and is one of the most stable factors in terms of predicting performance. However, magnitude values for the contribution of intelligence to determining achievement are of the order of moderate to medium-high, thus presenting considerable variation (Castejón & Navas, 1992; Navas, Sampascual, & Santed, 2003). Consequently, although some authors had questioned the relevance of this relationship (Descals & Rivas, 2002; Doring, 2006), most studies on the subject had obtained a particularly high relationship between intelligence and academic achievement, both on a correlational and predictive level (Chamorro-Premuzic & Furnham, 2006; Colom & Flores-Mendoza, 2007; Deary, Strand, Smith, & Fernandes, 2007; Watkins, Lei, & Canivez, 2007).

However, as mentioned previously, these studies have increasingly tended to include other factors of a motivational nature, which regulate and mediate between the intelligence of each subject and their final achievement, such as goal orientations, causal attributions, self-concept, effort and task value. Thus, integrating both variable types provides a more realistic vision of the cognitive and motivational fabric that determines students school performance; as stated by Pintrich (2003, p. 674), "understanding how motivational constructs explain the cognitive processes, integrating models of motivation and cognition".

In the learning process, goal orientations reflect the desire to develop, achieve and demonstrate competence in an activity, and can influence how students approach, respond to and commit to academic activities and other achievement experiences (Ames, 1992; Dweck & Leggett, 1988; Harackiewicz, Barron, & Elliot, 1998). Mastery-approach goals have been empirically related to improved academic achievement, together with other more adaptive motivational, cognitive and behavioural mediators within the learning process (Gehlbach, 2006; Harackiewicz, Barron, Pintrich, Elliot, & Thrash, 2002; Linnenbrink & Pintrich, 2000; Valle et al., 2009; Zimmerman, 2008), such as self-concept and self-efficacy (Long, Monoi, Harper, Knoblauch, & Murphy, 2007; Middleton & Midgley, 1997; Skaalvik, 1997), effort (Chouinard, Karsenti, & Roy, 2007; Elliot, McGregor, & Gable, 1999; Linnenbrink & Pintrich, 2000; Turner, Thorpe, & Meyer, 1998) and significant learning strategies (Dupeyrat & Marine, 2005; Elliot & McGregor, 2001; Grant & Dweck, 2003; Harackiewicz et al., 2000; Kolic-Vehovec, Roncevic, & Bajsanski, 2008; Shih, 2005;

Valle, Cabanach, Núñez, & González-Pienda, 2006). There also seems to be considerable consensus regarding the notion that mastery and performance-avoidance goals are those which correlate more closely to poor achievements in studies. However, there is less empirical evidence on the role of performance-approach goals in academic studies. Thus, whereas some consider it a somewhat non-adaptive goal that tends to be associated with unsatisfactory results (Dupeyrat & Marine, 2005), others do not consider it non-adaptive, particularly when compared with task avoidance (Butler, 2006; Midgley, Kaplan, & Middleton, 2001), or that it can be more or less adaptive depending on the circumstance (Pintrich, 2000b). To rectify this controversy, Senko and Harackiewicz (2005) stated that, whereas performance-approach goals were directly related to students' school achievement level, mastery-approach goals related more to interest, effort and persistence, so that the effect of this orientation on performance was mediated by the appropriate use of self-regulated learning strategies (Daniels et al., 2009; Valle et al., 2003a).

With regard to self-concept, the vast majority of studies obtain a statistically significant relationship between self-concept and academic achievement, particularly at more specific levels (Choi, 2005; González-Pienda et al., 2003), even obtaining the highest predictive ability from amongst the set of motivational variables (Mills, Pajares, & Herron, 2007; Robbins et al., 2004; Spinath, Spinath, Harlaar, & Plomin, 2006). It thus seems obvious that a subject's active involvement in the learning process increases when he/she feels self-competent, that is, when he/she trusts his/her own abilities and has high expectations of self-efficacy (Miller, Behrens, Greene, & Newman, 1993; Zimmerman, Bandura, & Martínez-Pons, 1992). In this case, specific self-concept is comparable with self-efficacy, as the latter includes "organising and implementing courses of action" (Bandura, 1986, p.391), which is a more specific and situational view of perceived competence, and is used in relation to a goal of some kind, which again shows that self-efficacy is more specific and situational in nature (Pietsch, Walker, & Chapman, 2003; Pintrich & Schunk, 2002). Nevertheless, determining a relationship between self-concept and performance is problematic, because of the difficulty in conceptualising self-concept, on the one hand, and on the other because of the reciprocal effects that occur within these relationships (Eccles, 2005), which are illustrated in the models put forward by Marsh and collaborators (Guay, Marsh, & Boivin, 2003; Marsh & Koller, 2004; Marsh, Trautwein, Ludtke, Koller, & Baumert 2005; Marsh & Craven, 2006; Marsh & O'Mara, 2008). Similarly, self-concept and self-efficacy are closely related to other motivational variables, such as goal orientations (Spinath & Stiensmeier-Pelster, 2003), causal attributions (Piñeiro, Valle, Cabanach, Rodríguez, & Suárez, 1999) and cognitive variables such as learning strategies (Rodríguez, Cabanach, Valle, Núñez, & González, 2004; Thomas et al., 1993).

Meanwhile, the suitable use of cognitive and metacognitive strategies can turn "taught" material into "learnt" material. In this way, the suitable use of deep learning strategies is positively related to academic performance (Chiu, Chow, & McBride-Chang, 2007; Martín, Martínez-Arias, Marchesi, & Pérez, 2008; McKenzie, Gow, & Schweitzer, 2004; Yip, 2007), though some authors have related them less to grades achieved but rather to the quality and significance of the learning. Nevertheless, as García and Pintrich (1994) stated, the use (rather than the knowledge) of this kind of strategy was mediated by or related to student motivation. For this reason, in most of the various structural models that have considered cognitive and motivational variables to explain academic achievement (in the line of causality) learning strategies come behind motivational variables such as self-concept, causal attributions or students' goal orientations (Bandalos, Finney, & Geske, 2003; Fenollar, Román, & Cuestas, 2007; Ruban & McCoach, 2005; Simons, Dewitte, & Lens, 2004; Swalander & Taube, 2007; Zhang & Richarde, 1999), playing a particularly relevant role in cases of intrinsic motivation. Furthermore, a reciprocal relationship can be observed between learning strategies used by students and the effort and interest that they show in performing school tasks (Meltzer et al., 2004).

Hypothetical model

The structural model considered aims to study to what extent the variables of motivation interact with other more cognitive variables, such as intelligence or learning strategies, in predicting school performance, which highlights the importance of studying aspects of self-regulated learning, together with intellectual skills or aptitudes, to develop a common theoretical framework (Grigorenko et al., 2009). However, after analysing the more recent structural models that have integrated cognitive and motivational variables (Bandalos et al., 2003; Fenollar et al., 2007; McKenzie et al., 2004; Swalander & Taube, 2007; Valle, Cabanach, Núñez, Rodríguez, & Piñeiro, 1999; Valle et al., 2003a; Zhang & Richarde, 1999), it is observed that they do not include variables related to intelligence or differential aptitudes. Hence, although the evolution of the research has shifted from considering intelligence as one of the main, if not the main, determining factor in academic achievement, to considering other personal factors with a volitive or motivational nature as predictors of the latter, it becomes necessary to: a) attempt to test the extent to which general intelligence or individual skills affect motivational variables; b) analyse whether the effect of the former on performance is mediated by the individual's motivation; and c) test whether motivational variables contribute to explaining academic achievement beyond general intelligence. Consequently, this paper aims to answer these matters.

As Figure 1 shows, general intelligence/aptitudes are expected to have a direct effect on goal orientations, which is positive for mastery-approach goals and negative for performance-approach goals. Thus, given that this is also a cognitive variable, it is expected to have a direct positive influence on the effective use of learning strategies (Ruban & McCoach, 2005), though this effect will also be mediated by the variables that refer to goals and the effort made. Finally, general intelligence is expected to have a direct and positive effect on final academic achievement.

Meanwhile, academic self-concept will affect mastery-approach goals, and performance-approach goals (Valle et al., 1999, 2003b). Therefore, as stated previously, this will have a positive effect on effort and on the use of learning strategies (Fenollar et al., 2007; Muis & Franco, 2009), as it is expected that students with greater self-concept will have greater involvement in their school tasks.

With regard to goal orientations, students with high scores in mastery approach will make a greater effort and deploy more significant learning strategies, which will mean high levels of academic achievement (Bandalos et al., 2003; Valle et al., 1999). However, students with high scores in performance-approach goals will only achieve satisfactory grades if they make an effort (Long et al., 2007), and use learning strategies to a sufficient degree. For this reason, it is expected that in this case the indirect effect on final performance through effort and strategies will be positive, whereas the direct effect will be negative (Phan, 2009).

Finally, effort is expected to have a positive effect on academic achievement (Corbiere, Fraccaroli, Mbekou, & Perron, 2006), both directly and indirectly, through the use of significant learning strategies.

Method

Participants

A total of 369 students from the first academic year of compulsory secondary education in three state and one private Spanish schools took part. 49 had been held back at least once, thus, whilst 86.72% were aged correspondingly to their school year (12 years old), the other 13.28% were aged between 13 and 15 years old. Furthermore, 28 had to be excluded due to errors or omissions in their answers, or because they did not have sufficient command of Spanish. This gave a total of $n = 341$. Random sampling by conglomerates was used to obtain the selection of the sample, with the group-class as the sampling unit. The gender split was such that 174 students (51%) were girls and 167 (49%) were boys. The majority (65.99%) were at state schools, with the rest (34.01%) at private schools. These percentages take into account the distribution of the Spanish student body in Compulsory Secondary Education offered by the Spanish Ministry of
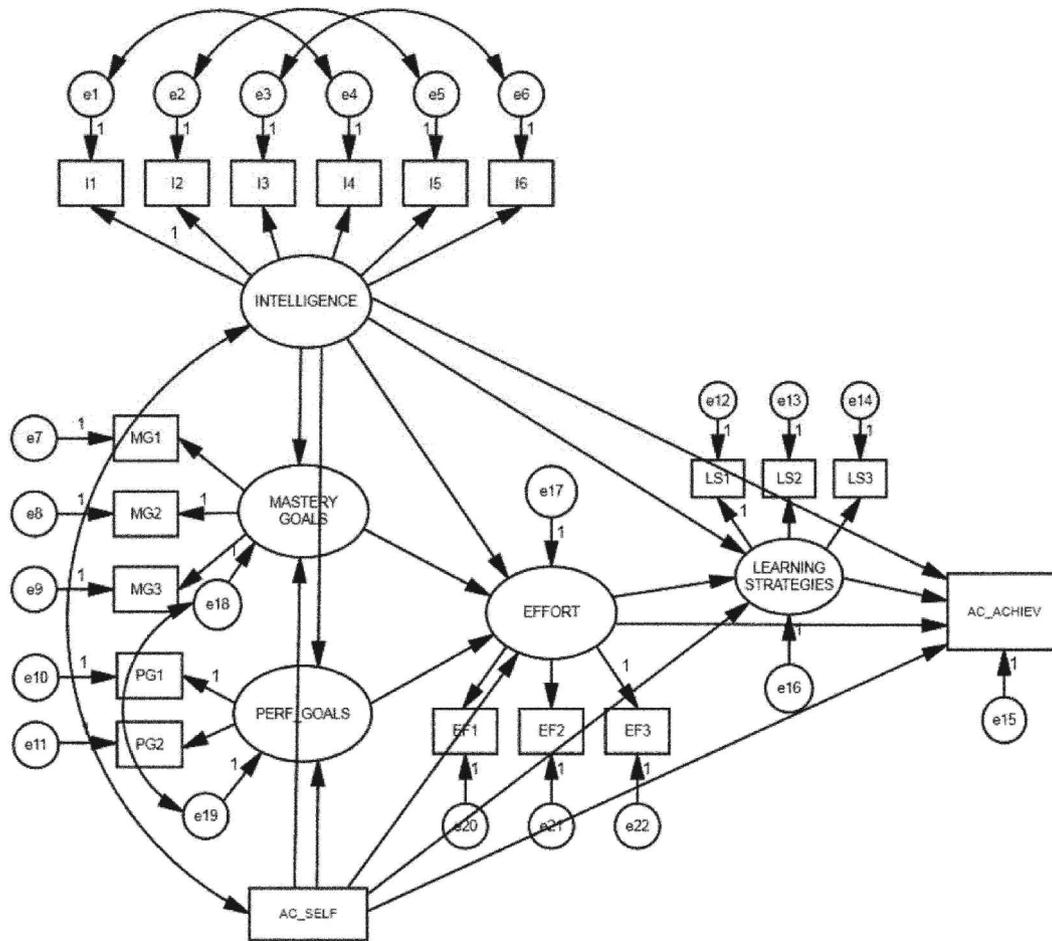
Figure 1. Hypothetical model. I1: Analogical relations; I2: Numerical series; I3: Logical matrixes; I4: Fill in the blanks; I5: Problem solving; I6: Figure series; MG1: Seeking increased competence vs. seeking avoiding negative opinions; MG2: Seeking increased competence vs. seeking positive opinions; MG3: Achievement inhibiting anxiety; PG1: Performance motivation; PG2: Achievement enabling anxiety; PERF_GOALS: Performance goals; AC_SELF: Academic self-concept; EF1: Interest in academic activities; EF2: Self-conceptualization as efficient; EF3: Self-conceptualization as a worker; LS1: Processing strategies; LS2: Personalisation strategies; LS3: Metacognitive strategies; AC_ACHIEV: Academic achievement.

Education according to the ownership of the centres during the 2009-2010 academic year, thus guaranteeing the utmost representativeness of the selected sample.

Variables and instruments

The structural model included the following variables:

Academic self-concept: This variable was measured using the ESEA-2 [Self-Concept Evaluation Scale for Adolescents] produced by González-Pienda et al. (2002). This questionnaire is a Spanish adaptation of the SDQ-II by Marsh (1990), validated in a study with 503 students in compulsory secondary education. It comprises 70 items measuring 11 specific self-concept dimensions, to which students must answer on a Likert scale from 1 to 6, depending on the extent to which they agree or disagree with each statement. In the authors' evaluation work, all

obtain Cronbach's alpha values of .73 to .91. For this study, only the academic self-concept factor was selected.

Goal orientations and effort: These variables were evaluated using the MAPE [Motivation Towards Learning Questionnaire] by Alonso and Sánchez (1992). The MAPE is comprised of 72 items used to determine the most relevant aspects of student motivation towards academic achievements, to which students must answer YES or NO depending on whether or not they agree with each statement. From these 72 items, the authors obtained a first-order eight-factor and second-order three-factor structure. The proposed model has used the second-order factors such as latent variables, extracted from variables observed corresponding to first order factors, which are conceptually equivalent to mastery-approach orientation, performance-approach orientation and effort. These obtain Cronbach's alpha values of .83, .87 and .77, respectively.

Learning strategies: To evaluate this variable, the CEA [Learning Strategies Questionnaire] was used, produced by Beltrán, Pérez, and Ortega (2006). The test evaluates four large scales or processes, into which the following strategies are grouped: awareness, development, personalisation and metacognition, of which only the latter three were taken as observed variables, given that the former has been assessed using other constructs. All these achieve alpha reliability scores of more than .77. To obtain the different scores for these three scales, students answered a total of 50 items, indicating the extent to which each formulated strategy was true, on a Likert scale from 1 to 5.

General intelligence: To obtain the data from this variable, the BADYG-M [Set of Differential and General Aptitudes] by Yuste, Martínez, and Galve (2005) was used. This is made up of nine sub-tests, six of which are basic, from which one score was obtained for general intelligence, together with three complementary scores. The six basic sub-tests, considered observed variables, consist of 32 elements, each with five answer choices, and with Cronbach's alpha values of .77 to .89.

Academic achievement: This variable was evaluated using the results obtained by the students end-of-year assessment, gathered from the various schools' records. An overall grade was considered, which was the final average score the students obtained in all subjects studied. This score was recorded on a scale of 0 to 10.

Procedure

Data was gathered in the classroom and during school hours. The tests were run simultaneously by several specialist collaborators, who received prior general training on how to apply the various instruments (purpose, instructions, times, etc.). Furthermore, the informed consent of students' parents or legal tutors was obtained for participation in the study. The study was carried out during four sessions over the course of an academic year, from November to March.

Data analysis

From the correlation matrix, structural equation analysis was used, following the maximum likelihood (ML) estimation method. The main objective of the research was to test a set of explanatory relationships between the variables which, according to a certain theoretical framework, have a significant influence on students' school achievement in cognitive and motivational terms.

Before applying SEM, it was particularly ensured that the normality and linearity were met. To ensure this hypothesis, the values of skewness and kurtosis (Table 1) were analyzed on one side, and, on the other side, the referred scatterplots that distribute the dependent variables along the independent variable for each relationship.

Table 1
Means, Standard Deviations, Skewness and Kurtosis of the Variables Included in the Model

Variables	Mean	*SD*	Skewness	Kurtosis
1. I1	15.82	6.43	-0.01	−0.77
2. I2	15.55	6.69	0.32	−0.65
3. I3	15.54	5.31	−0.04	−0.25
4. I4	16.68	6.44	−0.12	−0.77
5. I5	9.19	6.03	0.34	−0.35
6. I6	14.97	5.45	0.40	0.00
7. MG1	7.10	2.79	−0.63	−0.11
8. MG2	4.78	1.59	−0.56	−0.38
9. Performance goals	5.01	2.68	0.18	−0.58
10. Academic self-concept	4.54	1.19	−1.00	0.53
11. EF1	7.10	3.52	0.12	−0.89
12. EF2	6.28	1.74	−1.07	0.43
13. EF3	2.59	1.62	0.81	−0.07
14. LS1	56.04	11.35	−0.14	−0.50
15. LS2	68.66	14.05	−0.06	−0.46
16. LS3	37.08	6.70	0.17	−0.19
17. Academic achievement	6.25	1.77	−0.14	−0.62

Note: I1: Analogical relations; I2: Numerical series; I3: Logical matrixes; I4: Fill in the blanks; I5: Problem solving; I6: Figure series; MG1: Seeking increased competence vs. seeking avoiding negative opinions; MG2: Seeking increased competence vs. seeking positive opinions; EF1: Interest in academic activities; EF2: Self–conceptualization as efficient; EF3: Self–conceptualization as a worker; LS1: Processing strategies; LS2: Personalisation strategies; LS3: Metacognitive strategies.

All of the models were analysed under the assumption of multivariate normal distributions, as skewness and kurtosis values for the variables were in a range of ±1. Furthermore, the method of maximum likelihood used in AMOS 7 is robust for departures from normality, especially if the sample is large and the skewness and kurtosis values are not extreme, i.e., skewness values > |2| and kurtosis values > |7| (West, Finch, & Curran, 1995).

Equally, the scatter plots indicated that there was linearity between the variables studied, as the points showed the same dispersion throughout all the data values, with no regular or curved pattern, which would indicate a possible lack of linearity or the presence of heterocedasticity.

Finally, the diagnosis of outliers from the multivariate viewpoint, evaluated using the Mahalanobis distance, indicated that there were no outliers, as none lay below the significance threshold value of .001 (Hair, Anderson, Tatham, & Black, 1998). The AMOS 7.0 programme was used for all analyses.

Results

Validity of the measurement model and Model goodness of fit

The analysis of the level of global fit of the model presented commenced by evaluating the validity of the measurement model of the latent variables included. This required each variable to be assessed separately by studying the weighting of the statistical significance indicators, the reliability and the extracted variance measurements for each construct. Secondly, the absolute fit and the incremental fit indexes of the compared model were analysed using a null model.

However, in order to increase the validity of the measurement model for the latent construct, an indicator was eliminated from each of the goal orientations given the scarce variance and significance, with performance-approach goals remaining as the observed variable. Furthermore, so as to improve the model's global fit, the effect of academic self-concept on learning strategies was removed and the correlation between errors in academic goals was added, taking into account the modification indexes and the theoretical justifications of these relations.

Consequently, when studying the validity of the measurement model, all latent constructs obtained a reliability of over .73, i.e. above the recommended value of .70 (Hair et al., 1998). Likewise, extracted variance measurements exceed the recommended 50%, except in the case of the construct related to effort which verges towards 43%, given the low contribution of the EF3 indicator to the definition of the same. Thus, it is possible to assume an acceptable fit of the measurement model for latent constructs. Furthermore, in the indicators for the intelligence variable, the errors in indicators I1-I4, I2-I5 and I3-I6 have been correlated, given that they, respectively, addressed pairs of indicators for verbal, numerical and spatial aptitude. Likewise, indicators LS1 and LS2 of the learning strategies construct have been correlated given the cognitive character of both.

Secondly, absolute fit indexes were used to ensure the model fit, determining the extent to which the model predicts the observed covariances matrix. In this way, in the final model statistic χ^2 reached value of 270.92, $df = 109$, $p = .000$, which, initially, suggested that the desired fit had not been obtained. However, χ^2 may not be reliable for samples of more than 200 subjects (Bagozzi & Yi, 1988; Bollen, 1989), because the value is a direct function of sample size, making it preferable to analyse alternative indexes. Thus, the Goodness of Fit Index (GFI) value was .916, slightly above the .90 acceptance level. The Root Mean Square Error of Approximation (RMSEA), was .070, considered acceptable given the strong correlations with the original matrix. Similarly, as regards incremental fit measures, the normed fit and Tucker-Lewis indexes (NFI and TLI) were .906 and .918, respectively. Finally, the comparative fit index (CFI) is .938. The percentage variance explained in the criterion variable was 66% ($N = 341$, $\alpha = .01$, $p = .99$). All these values are detailed in Table 2.

Evaluation of individual parameters

With regard to the relationships between the latent variables, all the relationships proposed in the final model were significant at a level of $p < .05$, except for the effects produced by intelligence on mastery-approach goals and those on effort (Figure 2). The biggest standardized regression weighting was reached in academic self-concept-effort ($\beta = .608$, $SE = .059$, $p = .000$), followed by intelligence-academic achievement ($\beta = .590$, $SE = .021$, $p = .000$), and effort-learning strategies ($\beta = .516$, $SE = .983$, $p = .000$). Similarly, all the direct effects were positive, except for those produced by intelligence on performance-

Table 2

Fit Indexes of the Final Model

Model	χ^2	df	χ^2/df	p	GFI	AGFI	RMR	NFI	TLI	CFI	RMSEA	R^2
Hypothetical Model	399.17	134	2.98	.000	.891	.846	1.542	.871	.884	.909	.076	.655
Final Model	270.92	102	2.66	.000	.916	.874	1.535	.906	.918	.938	.070	.659

approach goals (β = − .281, *SE* = .038, *p* = .000), and effort (β = − .067, *SE* = .011, *p* = .321). The statistically significant indirect effects were those produced by academic self-concept on effort through mastery-approach goals (β = .109, *p* = .001), on learning strategies (β = .370, *p* = .001) and academic achievement (β = .161, *p* = .002) through effort; also statistically significant were the indirect effects of goal orientations on learning strategies (β = .154, *p* = .001; β = .155, *p* = .001) and on academic achievement (β = .067, *p* = .001; β = .067, *p* = .001), through effort, as well as the effect produced by effort on academic achievement through learning strategies (β = .064, *p* = .017).

Finally, the correlations between the exogenous variables intelligence and self-concept were positive and statistically significant. The correlation between the two goal orientations was also significant, but negative.

Discussion

As stated in the results sections, the model considered obtained a satisfactory data fit. Almost all the pathways included are significant, explaining 66% of the variance in academic achievement. However, in the analysis of such an explanation, two possible limitations should be taken into account, relating to the characteristics of the phenomenon measured. The first of these is the evaluation itself of learning. In effect, even though the term "academic achievement" is synonymous with academic grades, it is usually the case that these grades are only an institutional evaluation of the products of learning (Biggs, 1989) and less of having achieved profound and significant learning (Navas et al., 2003; Valle et al., 2003a). Thus, whereas achieving significant learning is usually associated with optimal levels of

Figure 2. Graphic representation of the results of the final model. I1: Analogical relations; I2: Numerical series; I3: Logical matrixes; I4: Fill in the blanks; I5: Problem solving; I6: Figure series; MG1: Seeking increased competence vs seeking avoiding negative opinions; MG2: Seeking increased competence vs seeking positive opinions; PERF_GOALS: Performance goals; AC_SELF: Academic self-concept; EF1: Interest in academic activities; EF2: Self-conceptualization as efficient; EF3: Self-conceptualization as a worker; LS1: Processing strategies; LS2: Personalisation strategies; LS3: Metacognitive strategies; AC_ACHIEV: Academic achievement.

performance, optimal levels of performance do not always produce significant levels of learning. Secondly, it should be remembered that education has a multi-causal origin, and a lower percentage of explained variance is therefore normal when there is a limited number of predictive variables. Furthermore, it is necessary to take into consideration the limitations that the causality concept presents if the variables are not measured at least two different times (Marsh & Craven, 2006; Marsh & O'Mara, 2008).

General intelligence has a significant influence on students' goal orientations and on the appropriate use of learning strategies. Thus, whereas students with greater ability are orientated towards mastery, students with more limited abilities are more performance-goal orientated. This conclusion seems obvious, particularly when considering that, on the one hand, a mastery-goal orientation means a much greater investment of a student's cognitive and metacognitive abilities, and that, on the other, the very tools of aptitude measurement contain an important influence of crystallized intelligence (Castejón, Pérez, & Gilar, 2010; Catell, 1971, 1987; Yuste et al., 2005), which in short means that they are markedly academic in nature. Thus, based on a circular relationship, if it is expected that mastery-orientated students will achieve better academic results, these positive results will be associated with better scores in the evaluation of aptitudes, which, as stated previously, will have a significant influence on students' goal orientations. Furthermore, the results indicate that the effect of intelligence on effort is only positive when it intervenes in learning goals, and negative in the direct relationship. That is, the most intelligent pupils will only make a greater effort when it is orientated towards mastery. To summarize, even though the high direct explanatory power of general intelligence in academic achievement is confirmed once again, it can also be observed that this effect is mediated by other motivational variables such as goal orientations, effort and self-concept, which also explain a variance percentage in addition to the academic achievement prediction when the effects of intelligence or aptitudes are controlled. Thus, of the total of the variance percentage explained by the variables of the model on final achievement (66%), 48% is contributed by indicators related to intelligence, and the other 18% by the rest of the variables. As set out below, this fact has a relevant practical significance in terms of psycho-educational intervention for the improvement of academic achievement.

Specific self-concept has a significant influence on students' goal orientations and on the effort made. However, even though this relationship was expected to be negative in the case of performance-goal orientation (Middleton & Midgley, 1997; Pintrich, 2000b; Skaalvik, 1997), the results show that students with a positive self-concept can be performance-goal orientated, although to a lesser extent, which coincides with the study by Bandalos et al. (2003). Similarly, unlike the results obtained by Fenollar et al.

(2007), it can again be observed that students with a greater specific self-concept make a greater effort in tasks than classmates with a lower self-concept (Schmidt, 2005), as they have a greater degree of confidence and security in their own abilities. It can also be observed, again, that there is a close relationship between academic self-concept and students performance.

Goal orientations have a significant effect on the effort made by students in school tasks. However, against expectation (Senko & Harackiewicz, 2005), both types of goals are positive ones, and obtain very similar scores. This fact may be explained by the considerations of multiple goals. According to such considerations, students do not have one kind of orientation or another, but rather can have both at the same time (Valle et al., 2003b). Indeed, research results show greater academic achievement particularly in students with a high level of orientation towards learning, and a moderate/high level towards performance (Barron & Harackiewicz, 2000, 2001; Bong, 2009; Harackiewicz, Barron, Elliot, Tauer, & Carter, 2002; Liu, Wang, Tan, Ee, & Koh, 2009; Midgley et al., 2001; Pintrich, 2000a, 2000b). Similarly, it can be observed that in the case of performance-goal orientation, only students that make a greater effort and have greater involvement in school tasks achieve positive academic results, which is why the indirect effect on performance through effort and the use of learning strategies is positive, and the direct effect of this orientation on final performance is negative.

Effort has a positive influence on students' academic achievement, both directly and indirectly through learning strategies. Thus, according to the various models, the appropriate use of these strategies is mainly determined by two variables: on the one hand, by a pupil's greater or lesser predisposition to effort (Swalander & Taube, 2007), and on the other, by the cognitive aptitudes of the corresponding subject matter (Ruban & McCoach, 2005).

Taken as a whole, these results indicate that –in line with our main hypothesis– cognitive or motivational variables included in the model provide a significant contribution to the prediction/explanation of academic achievement, above and beyond that provided by intellectual variables. This contribution achieves a sufficiently high value to be considered, apart from its statistical significance with practical significance, insofar as the school sphere can establish programmes for development, stimulation and the improvement of aspects such as self-concept, motivational orientations, dedication and effort and leaning strategies of students as part of the curriculum, to obtain increased performance. More specifically, favouring learning goals and improving academic self-concept come across as key aspects that must be included in programmes designed to improve performance. Furthermore, as appears in the model presented, these variables appear at the onset, and consequently their improvement can produce a domino effect that also involves the optimization of the variables they affect directly and indirectly.

Educational implications

From the results described above, some important implications for education can be derived:

Firstly, despite the importance of motivational variables, it is clear that intelligence still plays a decisive role in students' achievement. However, this fact, which can seem a little disheartening, needs to be qualified: in this research, intelligence was evaluated by a test of differential aptitudes with a consequently high content of crystallised intelligence. Thus we can understand that a certain level of academic achievement is already implicit in the results obtained by students in the intelligence test. In addition, in this case, the intelligence variable is not as stable as it might seem, as it can be optimised through an appropriate instruction process. Therefore, what would be valuable would be to see if this predictive power could be found again when intelligence were evaluated by a test of *g* factor.

Secondly, students' goal orientations and their academic self-concept strongly influence the effort they make and consequently their involvement in deep learning. Thus, given that both variables are determined to a large extent by students' previous achievement (Miñano & Castejón, 2010, 2011), it is essential that teachers strive for all students to reach a certain level of success, which is key if students are to undertake the learning process with higher motivation. In this sense, adaptations of the curriculum towards a higher focus on diversity have an important justification.

Lastly, as we have indicated, if students' motivation and their disposition to effort largely explain the appropriate use of significant learning strategies, the low influence that learning strategies seem to have on final achievement is striking. That is, the fact that students have demonstrated interest in learning, effort and dedication to school work in the hope of a quality outcome does not necessarily imply that they will obtain good academic results. This leads us to question again to what extent school evaluations are consistent with a model of significant learning or, in other words, if the teachers' teaching processes are consistent with students' learning processes. It seems clear, therefore, to improve teaching and evaluation methods so that they are orientated to deep and significant learning of the subject, rather than a mere superficial and memory-based learning.

Implications for future research

Finally, with regard to future research, it would be useful to analyse whether the models considered are reproduced according to relevant differential criteria in students, by subdividing the sample using a multi-group analysis in terms of factorial invariance. Similarly, this model should be considered with the inclusion of other particularly relevant cognitive or motivational variables, such as causal attributions or students' expectations, in order to obtain a more complete vision of all the intrapersonal variables involved in the learning process.

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