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Creativity and perceived multiple intelligences as predictors of scholastic aptitude in primary education

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Abstract

Introduction. Further inquiry into constructs such as creativity, intelligence and scholastic abilities, and understanding how they relate to each other, can promote better understanding of the variables involved in academic achievement. Consequently, the objective of the present study was to examine the predictive value of creativity and multiple intelligences (self-perceived, perceived by families and by teachers) in scholastic aptitudes related to academic achievement in primary education.

Method. For this purpose, 98 third- and sixth-graders from several schools of the north of Spain completed different tests: an objective test of creative intelligence (CREA), a scholastic aptitude test (TEA1) and a self-report questionnaire on their perceived multiple intelligences. In addition, parents and teachers also completed a questionnaire on the multiple intelligences of the participating students.

Results. The results of the linear regression showed that students' creative intelligence predicted students' non-verbal scholastic aptitudes in part, and that naturalistic, linguistic and logical-mathematical intelligences showed some predictive ability of students' general scholastic ability, and of verbal and non-verbal components in particular.

Discussion and conclusions. Creativity and some multiple intelligences were predictive of scholastic aptitudes, but not in the same way, and without generalized agreement among the informants. Teachers were taken to be the group that most accurately assessed levels of multiple intelligences that were predictive in this study.

Keywords: creativity, multiple intelligences, scholastic aptitudes, primary education.

Abstract

Introducción: La profundización en constructos como creatividad, inteligencia y aptitudes escolares, y comprender cómo se relacionan entre ellos, puede favorecer un mejor entendimiento de las variables implicadas en el rendimiento académico. Por tanto, el objetivo del presente estudio ha sido examinar el valor predictivo de la creatividad y las inteligencias múltiples (auto-percibidas, percibidas por familias y por profesorado) sobre las aptitudes escolares relacionadas con el rendimiento académico en Educación Primaria.

Método: Para ello, 98 estudiantes de 3^er^ y 6º curso de varios centros educativos del norte de España cumplimentaron diferentes pruebas: una prueba objetiva de evaluación de inteligencia creativa (CREA), un Test de Aptitudes Escolares (TEA1) y un cuestionario de autoinforme sobre sus inteligencias múltiples percibidas. Así mismo, padres y profesores también cumplimentaron el cuestionario sobre las inteligencias múltiples del alumnado participante.

Resultados: Los resultados de la regresión lineal mostraron que la inteligencia creativa de los estudiantes predice, en parte, las aptitudes escolares no verbales de los alumnos y que la inteligencia naturalista y las inteligencias lingüística y lógico-matemática muestran cierta capacidad predictiva sobre las aptitudes escolares de los alumnos, en general, y sobre los componentes verbal y no verbal, en particular.

Discusión o conclusión: Se observa cierta capacidad predictiva de la creatividad y de algunas inteligencias multiples sobre las aptitudes escolares, pero no de la misma forma y sin acuerdo generalizado entre informantes, entendiendo que el profesorado es el colectivo que muestra mayor precisión para valorar el nivel de las inteligencias múltiples que han resultado predictoras en este estudio.

Palabras Clave: creatividad, inteligencias múltiples, aptitudes escolares, educación primaria.

Introduction

Of the factors that significantly intervene in the educational process, most notable are variables that describe the learning context, teacher variables, and student variables (Hattie, 2009). Regarding the student, different cognitive and non-cognitive constructs have been studied in recent decades, in the attempt to analyze their importance and how they interrelate to ensure academic success at school. Examples include personality, intelligence, creativity, motivation and self-concept (Almeida et al., 2010; Doerrenbaecher & Perels, 2016; Gajda, 2016; Prast, Van de Weijer-Bergsma, Miocevic, Kroesbergen & Van Luit, 2018). The present study focuses attention on two of the cognitive constructs mentioned: creativity and intelligence, and their relation to the scholastic aptitudes needed for students to be successful academic achievers.

Regarding creativity, while there is some agreement that it involves the ability to produce a great number of ideas --original, useful, or task-appropriate (Plucker, Beghetto & Dow, 2004)-- and that it is behind the great advances of mankind (Sánchez-Ruíz & Hernández-Torrano, 2014), it remains a difficult construct to define, due to lack of agreement among authors and theories that seek to explain and measure it. Some authors consider creativity to be a general domain, where people show a level of creative attainment or performance independently of the discipline or task they are working on. Other authors consider that creativity is dependent on a specific domain, that is, it is linked to the domain of the proposed task. So it is that certain persons are able to show high levels of creativity in some specific areas of learning, such as art and music, and low levels of creativity in other areas (Bernal, Esparza, Ruiz, Ferrando & Sainz, 2017; Mourgues, Tan, Hein, Elliot & Grigorenko, 2016; Yi, Sulaiman & Baki, 2011).

Creativity and academic aptitudes/achievement have been linked in different studies (e.g. Kaufman & Plucker, 2011; Nori, Signore & Bonifacci, 2018), although the strength of the relationship found is not uniform across the different investigations. Authors like Gajda, Karwowski and Beguetto (2017) claim that how creativity and academic aptitudes/achievement are conceived, and hence measured, is one cause of these uneven results. Creativity has been associated with intellectual ability on tests of crystallized intelligence, more than on tests that measure fluid intelligence (Gajda, 2016); it has been associated with better academic outcomes when the tests used to measure creativity were objective tests, when creativity was understood to be a general domain (Mourgues et al., 2016) and when creativity was addressed from the angle of its cognitive components (Gajda, 2016). In addition, the strength of this association was seen to be greater when performance was measured with standardized tests instead of using school grades assigned by teachers (Gajda, 2016).

Keeping this in mind, the present study has used a creative intelligence test to measure creativity and takes this cognitive variable to be a general domain that may be activated in any type of task (Corbalán & Limiñana, 2010).

Regarding intelligence, specifically multiple intelligences, Gardner (2010, p. 29) defines it as “a biopsychological potential to process information, able to be activated within a cultural framework for solving problems or creating products that hold value for that culture”. Therefore, rather than viewing intelligence from a unitary perspective, Gardner proposes that each person presents different strengths and potential in different domains and at different levels, which can be trained, and which may or may not result in meaningful products (García, Fernández, Vázquez, García & Rodríguez, 2018). Keeping this in mind, he proposes that intelligence be conceptualized as eight types: 1) verbal-linguistic, 2) logical-mathematical, 3) visual-spatial, 4) bodily-kinesthetic, 5) musical-rhythmic, 6) naturalist, 7) social-intrapersonal and 8) social-interpersonal (Neubaguer, Pribil, Wallner & Hofer, 2018), and nine types if we consider existentialist intelligence (Bowles, 2008).

The relationship between Gardner’s multiple intelligences and academic achievement has been studied on numerous occasions (Ekinci, 2014), but less attention has been given to their possible relationship to traditional tests of intelligence ability or scholastic aptitudes. Authors like Almeida et al. (2010) claim that there is reasonable correlation between the results obtained from measuring students’ abilities from both theoretical approaches (MI and intellectual ability), while there is also relative independence between them. Even so, they also note that the relationship is not always as expected (e.g. low relationship between linguistic intelligence and verbal reasoning; low relationship between visual-spatial intelligence and numerical ability; high relationship between naturalist intelligence and abilities measured by classic tests of intelligence).

Taking into account constructs like creativity and multiple intelligences, and understanding how they relate to intellectual and academic aptitudes, can encourage better comprehension and promotion of students’ individual abilities and achievement (Peña, Ezquerro &

López, 2017). However, researchers have yet to reach complete agreement about the relationship that exists between the variables used to identify these constructs (Almeida et al., 2010; Nori et al., 2018). The objective of this study, therefore, was to examine the predictive value of creativity and multiple intelligences (self-perceived, perceived by families and by teachers) on students' scholastic aptitudes that help them progress favorably at school. It is important to note that, while intelligence and academic aptitudes are qualitatively and quantitatively different dimensions, in this study we have chosen to use an aptitude measure that assesses components broadly related to students' learning and performance on school tasks: a verbal and a nonverbal component, whose combination produces a score for measuring intelligence-IQ (Thurstone & Thurstone, 2005).

Objective

The objective of this study was to examine the predictive value of creativity and multiple intelligences (self-perceived, perceived by families and by teachers) on scholastic aptitudes that help students progress favorably at school.

Method

Participants

The sample was made up of 98 third- and sixth-graders (3rd: n = 48, 49%; 6th: n = 50, 51%) from different schools located in urban, middle-class districts in the north of Spain. Students' age ranged from 8 to 12 years (M = 10.03; SD = 1.62). Regarding gender, 58 students were boys and 40 were girls (59.2% and 40.8% of the total, respectively). No statistically significant differences were observed in the proportion of students by schoolyear and by gender [schoolyear and male gender (*Z score* = .90; p = .368); schoolyear and female gender (*Z score* = 1.84; p = .066). Students from third and sixth grade were selected as representative of primary education since their cognitive development and reading-writing levels allow them to answer self-report questionnaires with some reliability.

Instruments

The following tests were administered for the purpose of assessing scholastic aptitudes, creativity and perceived multiple intelligences.

TEA: Test de Aptitudes Escolares [scholastic aptitudes test] (Thurstone & Thurstone, 2005). This test evaluates the subject's aptitude for learning, and students' scores can be converted into a measurement of intellectual ability or IQ. Three different aptitudes are measured (verbal, numerical and reasoning) through the use of five subtests (drawings, different word, vocabulary, reasoning and arithmetic). It also offers the option to separately measure verbal and nonverbal aptitudes, understood to be foundational to correct execution of academic tasks, along with other aptitudes and variables. The TEA1 version was applied in the present study, since its age of application corresponds to our sample; we recorded IQs obtained from the complete test, and students' direct scores on the variables related to verbal and nonverbal aptitudes. Regarding the test's psychometric properties, Ruiz-Alva (2002) showed reliability coefficients of .90 to .93 for the different tests, as well as significant correlations with mathematics and language achievement in a sample of 5980 students from third to sixth grade.

CREA. Inteligencia creativa [creative intelligence] (Corbalan et al., 2003). The test requires the subject to form as many questions as they can, within a four-minute time window, about a drawing shown to them on a sheet. A different drawing is presented according to the child's age. In the present study, Sheet C was used, as corresponded to the age of our sample. The test offers a measure of general creative intelligence depending on the number and structure of the questions produced. The present study made use of the direct test scores, which reflect the number of correct responses. The manual offers detailed information on psychometric studies carried out with the test, showing a reliability of .87 in parallel forms, analysis of convergent validity with Guilford tests (r= .61; r=.75; r=.59; r=.48), discriminant validity with intelligence tests (r=.25; r=.20) and predictive validity with scores of experts in creative work (Corbalán et al., 2003). More recently, Clapham and King (2010) analyzed the psychometric properties of the test in a sample of English-speakers, finding good convergent validity with other traditional tests of creativity, specifically, *The Verbal and Figural Torrance Tests of Creative Thinking – TTCT* (Torrance, 1966), and moderate test-retest reliability over a two-year period.

Perceived multiple intelligences. These were assessed using three scales based on the Theory of Multiple Intelligences (Gardner, 1983), first drafted by Armstrong (1999), and later translated and adapted to a Spanish population (Llor et al., 2012; Prieto & Ballester, 2003). A different scale was used for each of the three educational agents involved in the learning process: students, parents and teachers. Each scale contained 28 items (with Likert-type response options from *1 = never* to *4 = always*). Each multiple intelligence in each scale is assessed through four items. For our purposes, intrapersonal and interpersonal intelligence were assessed jointly as the single entity of social intelligence.

In the present study, the students' scale presented a reliability index of .69, while there were higher indices for the scales completed by teachers (α = .96) and families (α = .86).

Procedure

The participating schools were selected by convenience (schools that agreed to participate in the investigation). Once selected, the administrative team at each school was informed regarding the research objective being pursued, and about the confidential and ethical treatment of the data. When the school principals agreed to participate, informed consent was obtained from the families before proceeding to perform the assessments. Assessment was carried out with the children in three sessions on three consecutive days (the source investigation required the completion of more tests), and administration was counterbalanced (CREA, TEA1 and self-report). The assessment was carried out by researchers in training who had received instruction on how to apply the tests. The multiple intelligences scales to be completed by the families were sent and collected by the teachers, who later turned them in to the researchers, along with their own completed scales.

Data analyses

Descriptive analyses, mean, standard deviation, asymmetry and kurtosis were carried out, as well as correlations analyses between variables (*Pearson correlations*). Asymmetry and kurtosis values met the criteria proposed by Finney and Di Stefano (2006) for the use of parametric tests. Multiple regression analyses were carried out, with dependent variables TEA1 (IQ), TEA1-verbal and TEA-nonverbal, in order to analyze the predictive value of creativity and multiple intelligences (as perceived by the three types of informants) on students' academic aptitudes. The effect was examined as a function of the R^2 coefficients of the regression analyses, using the stepwise method. In order to estimate effect size, Cohen's practical significance criteria (Cohen, 1988) (f^2), based on the R^2 value, were taken into account, using the following formula: Cohen's $f^2 = r^2/(1 - r^2)$ (Selya, Rose, Dierker, Hedeker & Mermelstein, 2012). Thus, an effect is considered small, medium or large when f^2 has values close to .02, .15 or .35, respectively. As an additional estimate of the predictive power of each of the variables, we also considered the non-standardized and typified coefficients associated with the regression equation (Table 3). Age and gender (dichotomous variable codified as a dummy variable) were included as predictive and control variables. The statistical analyses were carried out using SPSS version 19.0. Differences were interpreted as statistically significant from $p \leq .05$.

Results

Table 1 presents the descriptive statistics of the variables included in the study. The mean of participating students' general intellectual aptitudes was near the mean of the test ($M = 102.14$; $SD = 14.73$), while the mean scores of the verbal and nonverbal components of the TEA1 were similar, with a similar aptitude level observed in both variables. The mean of the creativity variable was less than 10, with a variability of almost 4 points. The maximum score obtained in the sample was 20, indicating that the creative intelligence mean in our sample was generally not very high.

Table 1. *Descriptive statistics of the study variables.*

	Min.	***Max.***	***Mean***	***SD***	***Asym.***	***Kurt.***
Scholastic aptitudes and creativity						
TEA1-IQ	65	135	102.14	14.73	-.25	.11
TEA1-verbal	9	48	31.42	7.62	-.26	.04
TEA1-nonverbal	11	72	32.50	9.63	1.05	2.53
Creativity	2	20	8.99	3.95	.67	-.06
Multiple intelligences (students)						
Linguistic	5	16	11.63	2.42	-.54	.04
Naturalist	4	16	12.16	2.58	-.81	.63
Musical	5	16	11.83	2.79	-.21	-.89
Social	7	16	11.79	2.18	.06	-.63
Logical-mathematical	5	16	10.88	2.22	-.27	.12
Visual-spatial	5	16	11.72	2.41	-.07	-.44
Bodily-kinesthetic	7	16	11.85	2.11	.15	-.59
Multiple intelligences (teachers)						
Linguistic	5	16	10.37	2.56	-.13	-.21
Naturalist	4	16	10.57	2.82	-.18	-.49
Musical	4	16	9.89	2.35	-.04	-.20
Social	4	16	10.81	2.80	-.16	-.30
Logical-mathematical	4	16	10.37	2.95	.01	-.56
Visual-spatial	4	16	10.03	2.80	-.27	-.25
Bodily-kinesthetic	4	16	9.93	2.11	.03	.44
Multiple intelligences (families)						
Linguistic	6	16	11.19	2.33	.15	-.56

Naturalist	6	16	11.30	2.34	-.2852	-.41
Musical	5	16	11.03	2.71	-.3054	-.55
Social	7	16	12.19	2.42	-.30	-.82
Logical-mathematical	5	16	9.68	2.52	.32	-.26
Visual-spatial	5	16	10.48	2.50	.01	-.53
Bodily-kinesthetic	5	16	11.09	2.56	-.10	-.62

Note. Min. = minimum; Max. = maximum; SD = standard deviation; Asym. = asymmetry; Kurt. = kurtosis

As for perceived multiple intelligences, the mean values of each scale for each multiple intelligence (maximum value = 16) were above the scale mean, ranging between 9 and 12 points, with no differences found between the different informants.

Table 2. *Table of correlations between variables*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1.	-																								
2.	.60**	-																							
3.	.59**	57**	-																						
4.	.21**	34**	.36**	-																					
5.	.02	-22**	-.12	-.04	-																				
6.	.03	-10	-.02	-.05	.27**	-																			
7.	.02	-.04	.04	.09	.32**	.23**	-																		
8.	-.01	-.12	-.11	.02	.49**	.25**	.33**	-																	
9.	-.07	-.09	.02	-.02	.28**	.20**	.25**	.26**	-																
10.	.04	-22**	-.16*	-.06	.32**	.22**	.25**	.37**	.23**	-															
11.	-.01	-.09	-.05	-.01	.24**	.17*	.35**	.35**	.38**	.33**	-														
12.	.42**	.32**	.19*	.24**	.16*	.04	.07	.13	-.05	.07	.02	-													
13.	.42**	.26**	.16*	.26**	.13	.10	.10	.07	.05	.04	-.01	.84**	-												
14.	.34**	.21*	.11	.21*	.14	.03	.15*	.01	-.09	-.04	-.05	.70**	.68**	-											
15.	.29**	.28**	.23**	.26**	.00	-.04	.03	-.00	-.05	-.09	-.11	.63**	.63**	.55**	-										
16.	.43**	.30**	.24**	.23**	.11	.06	.09	.06	.06	.06	.03	.83**	.87**	.65**	.65**	-									
17.	.39**	.28**	.16*	.25**	.09	.04	.14	.07	-.05	.09	.01	.79**	.82**	.71**	.64**	.83**	-								
18.	.28**	.17*	.08	.19*	.13	.04	.12	.11	-.07	.00	-.00	.68**	.60**	.60**	.61**	.60**	.72**	-							
19	.12	.06	-.00	-.17*	.24**	.11	.12	.18*	.18*	.15*	.04	.19*	.18*	.13	.16	.16*	.17*	.16*	-						
20.	.25**	.18*	.14*	-.01	.08	.14*	.17*	.05	.29**	.11	.14*	.06	.18*	.05	.10	.14	.12	.07	.58**	-					
21	.09	.02	.05	.07	.05	.11	.30**	.13*	.20*	.01	.17*	.09	.11	.11	.14	.09	.11	.18*	.37**	.46**	-				
22.	.13	.04	.07	.13	.04	.04	.07	.11	.13*	-.00	.06	.22*	.23*	.19*	.35**	.19*	.24*	.23*	.42**	.45**	.45**	-			
23	.18*	.05	.07	.00	.13	-.02	.08	-.00	.24**	.04	.10	.06	.10	.04	.09	.19*	.11	.07	.51**	.59**	.36**	.35**	-		
24.	.17*	.10	.09	.03	.08	.08	.17*	.11	.24**	.12	.11	.10	.14	.08	.17*	.17*	.23*	.18*	.47**	.58**	.47**	.39**	.63**	-	
25.	.04	-.03	-.02	.00	.07	.07	.18*	.21*	.14*	.12	.15*	-.05	.-05	.03	.02	.02	.04	.17*	.35**	.43**	.49**	.24**	.34**	.53**	-

Note. 1 = TEA1-IQ; 2 = TEA1 verbal; 3 = TEA1 nonverbal; 4 = creativity; 5 = Linguistic Intelligence (Student); 6 = Naturalist int. (Student); 7 = Musical int. (Student); 8 = Social int. (Student); 9 = Logical-mathematical int. (Student); 10 = Visual-spatial int. (Student); 11 = Bodily-kinesthetic int. (Student); 12 = Linguistic int. (Teacher); 13 = Naturalist int. (Teacher); 14 = Musical int. (Teacher); 15 = Social int. (Teacher); 16 = Logical-mathematical int. (Teacher); 17 = Visual-spatial int. (Teacher); 18 = Bodily-kinesthetic int. (Teacher); 19 = Linguistic int. (Family); 20 = Naturalist int. (Family); 21 = Musical int. (Family); 22 = Social int. (Family); 23 = Logical-mathematical int. (Family); 24 = Visual-spatial int. (Family); 25 = Bodily-kinesthetic int. (Family).
* $p \leq .05$; ** $p \leq .001$

Table 2 shows the correlations between the study variables. A positive but low correlation can be observed between the variables that measure competence (TEA) and creativity. Most of the MI reported by the teachers show a positive but low correlation with the competence variables (TEA) and creativity, while this is not true of MI assessed by students or families. On the other hand, positive, moderate correlations are observed between the MIs perceived by the same agents, especially in the case of the teachers, while this pattern is not observed when the informants are different.

Table 3 shows the linear regression results organized according to the dependent variables used (TEA1-IQ, TEA1-verbal and TEA1-nonverbal). Only the coefficients for variables with statistically significant results in the different models are shown.

Table 3. *Results of the Multiple Linear Regression (stepwise). Non-standardized, typified coefficients and statistical significance*

	Non-Standardized coefficients		*Typified coefficients*			
	B	*Standard error*	*Beta*	*t*	*ANOVA*	R^2 (Cohen's f^2)
Dependent Variable: IQ on TEA1.						
Constant	60.660	7.730		7.85 ***		
F. Naturalist	2.482	.610	.40	4.07 ***	*F*(3,94) = 17.95 ***	.36 (.562)
F. Linguistic	-1.665	.635	-.26	-2.62 **		
T. Linguistic	3.094	.493	.54	6.28 ***		
Dependent Variable: TEA1-verbal						
Constant	-19.299	6.032		-3.20 **		
Age	3.067	.376	.65	8.16 ***	*F*(3,94) = 25.89 ***	.45 (.818)
T. Linguistic	1.047	.234	.35	4.48 ***		
F. Naturalist	.806	.254	.25	3.17 **		
Dependent Variable: TEA1-nonverbal						
Constant	-17.746	8.698		-2.04		
Creativity	.576	.234	.24	2.46 **		
Age	2.616	.604	.44	4.33 ***	*F*(4,93) = 12.35 ***	.35 (.538)
S. Naturalist	1.046	.340	.28	3.08 **		
T. Logical-mathematical	.589	.286	.18	2.06 *		

Note. The initials "S", "T", and "F" refer to the informant on the multiple intelligence questionnaires (students, teachers, and families, respectively).
$^*p \leq .05$, $^{**}p \leq .01$, $^{***}p \leq .001$

One may observe how the group of statistically significant predictive variables was different for each dependent variable. The percentage of variance of the dependent variable explained by the predictive variables was 36.4% in the case of the TEA1-IQ ($R = .60$; $R^2 = .36$), 45.2% in the case of the TEA1-verbal ($R = .67$; $R^2 = .45$), and 34.7% for the TEA1-nonverbal ($R = .59$; $R^2 = .35$), these percentages being statistically significant. The effect sizes associated with R^2 were high in all cases (f^2 in Table 3), with the highest value appearing when the dependent variable was the verbal component of the TEA1. Keeping in mind the contribution of each variable introduced into the equation separately, the regression coefficients in Table 3 showed how linguistic intelligence (teachers), in the case of TEA1-IQ, and age, in the case of TEA1-verbal and TEA1-nonverbal, are the variables that most contribute to explaining the differences in the dependent variables.

The creativity variable, finally, was significantly predictive only for the dependent variable TEA1-nonverbal --not so for TEA1-verbal nor for the general ability component (TEA1-IQ). This variable had medium weight in the regression equation, as indicated by the standardized coefficients.

As for the perceived multiple intelligences, assessed by the different informants, the only variables that proved to be statistically significant were linguistic, logical-mathematical and naturalist intelligences, although the direction of the relationship between these intelligences and performance in each of the aptitudes varied depending on the informant. Specifically, according to the perception of the families, linguistic intelligence was negatively related to the students' general aptitude (TEA1-IQ). However, if we look at the teacher perception, this same variable of linguistic intelligence positively predicted students' general aptitude and the verbal component of the TEA1, being a relatively weighty variable in the regression equation. Similarly, from the point of view of the teachers, logical-mathematical intelligence also acted as a predictive variable of the nonverbal component of the TEA1, although with lower weight.

In regard to naturalist intelligence, as pereived by students and families, it was observed to be a predictive variable playing an important role in students' general aptitude (TEA1-IQ), as well as as in each of its components (verbal and nonverbal).

Regarding the control variables, gender and age, only age significantly predicted students' performance on the verbal and nonverbal components of the TEA1, such that an increase in students' age was related to an increase in both components.

Discussion and Conclusions

The objective of this study was to examine the predictive value of creativity and multiple intelligences (self-perceived, perceived by families and by teachers) on students' scholastic aptitudes, using a sample of students from third to sixth grade of primary education.

Despite the interest shown by researchers over decades, the nature of the relationship between creativity and academic achievement or ability is still cause for debate (Gajda et al., 2017; Jauk, Benedek, Dunst & Neubauer, 2013; Nori et al., 2018). The present study has analyzed the predictive ability of creative intelligence on intellectual ability, understanding the latter to be scholastic aptitude in general (TEA1) and each of its components (verbal and nonverbal).

The strength and direction of the relationship between ability and creativity varies according to the different research studies (Gajda, 2016), although many studies, including the present study, do find this relationship independently of the direction or study methodology followed (Batey, Furnham & Safiullina; Silvia 2008). For example, in the test of applied creativity itself, the CREA (Corbalán et al., 2003), discriminant validity was analyzed using the ability test TEA2 (as well as others), and creativity was observed to be somewhat predicted by aptitude. Nonetheless, the strength of the relationship was lower than that observed in the present study; bear in mind that, in our case, we have studied how creativity predicts aptitude.

The results show how the creativity variable significantly predicts part of the aptitudes shown by the participating students. Specifically, it predicts nonverbal aptitudes, but not the verbal component or the test of scholastic aptitudes in general. This may be explained by the characteristics of the subtests that make up the nonverbal component of the TEA1, and by the type of task performed in the CREA. The CREA is scored according to the number of correctly formulated questions that are produced within the time allowed, hence, both reasoning and processing speed are important -- and this is also true of the TEA1-nonverbal. In any event, Torrance's threshold hypothesis (Jauket al., 2013), the most widely accepted explanation of how the variables of intelligence and creativity interact, is once again confirmed: there is a correlation between the two variables, significant at a level of $p \leq .001$ (see Table 2). Nonetheless, given the limited sample size, it would be appropriate to replicate these results to analyze whether the predictive power of creativity is maintained, and so further examine the relationship that is established. Even so, with creativity (CREA) being a task of divergent production (divergent thinking) and intelligence (TEA1) a task of convergent production, it is to be expected that one variable's level of prediction of the other is never going to be very high.

Regarding multiple intelligences, the results reflect that naturalist, logical-mathematical and linguistic intelligence significantly predict students' achievement on the aptitudes test used here, although different informants give different importance to one or another intelligence according to the components of the aptitudes evaluated (General IQ, verbal or nonverbal component).

Regarding linguistic and logical-mathematical intelligences and their significance as predictive variables, results are as expected in that these intelligences pertain to the type of learning that is most pursued in the current educational system. Priority is given to the logical-mathematical and social-linguistic areas, while social, bodily-kinesthetic, visual-spatial and musical intelligences are connected with other types of abilities and competencies that have less weight in the academic context, and therefore, less weight in the scholastic aptitudes related to academic achievement.

The linguistic and logical-mathematical multiple intelligences, assessed according to teacher perception, act as predictive variables for the measurement of aptitudes in general, and for measurements of their components. The results show how linguistic intelligence explains part of the verbal component of the test, while logical-mathematical intelligence explains part of the nonverbal component. Teachers appear to be the group that most accurately assesses these two intelligences. In the present study, the relationship established between the variables was as expected, unlike in the study by Almeida et al. (2010), where this did not occur. These authors also used scales to assess students' expertise, but as a reference for completing the scales, they used students' performance on a specific activity for each type of multiple intelligence (tasks proposed by Gardner, Feldman and Krechvsky in 1998, cited in Almeida et al., 2010). In the current study, three different questionnaires were used, joining the perceptions of students, teachers and families about the students' multiple intelligences, based on the perception of the student's expertise in general, without using any specific tasks to evaluate them. Once more, it can be observed that this type of scale represents an appropriate way to evaluate MI in students, and can offer valid information about the students' profile of abilities (Chan, 2008; Llor et al., 2012; Pfeiffer, 2015).

It is important to underscore the influence of naturalist intelligence (as perceived by students and their families) on the general measurement of scholastic aptitudes (TEA1-IQ), as well as on its components TEA1-verbal and TEA1-nonverbal. According to these two groups of informants, greater naturalist intelligence predicts greater achievement in scholastic aptitudes in general, and in each of its components. These results are similar to those found by Almeida et al. (2010), where naturalist intelligence was the intelligence mostly strongly related to performance indices that were measured with classical intelligence tests. Naturalist intelligence relates to aspects of learning such as curiosity, observation, experimentation, and drawing links between different events. All these aspects, inasmuch as they are generalized to the academic learning process, would reasonably be present and be predictors of scholastic aptitudes, regardless of whether these are verbal or nonverbal.

As for the control variables, age was a predictor of the scholastic aptitudes assessed, but gender was not. As students advance in age, age was observed as having more weight in the verbal and nonverbal test scores. This is reasonable if we consider that the TEA1 is not only a test for evaluating ability, but it actually assesses scholastic aptitudes. So it is logical to think that as students continue to learn in the academic context, their scholastic aptitudes increase (Fernández, García, Arias-Gundín, Vázquez & Rodríguez, 2017).

Finally, certain study limitations should be mentioned. The sample size is not very large, so we must be prudent when it comes to generalizing the results. It would be useful to replicate the study with broader samples, and given that age is influential, analyze whether these results are maintained in other stages of education, such as compulsory secondary education. On the other hand, creativity was measured here with a single test; results might differ if tests or measures were used that conceptualize creativity in a different manner. Finally, multiple intelligences have been assessed according to how students, their families and their teachers perceive the students' tendencies, preferences, and ways of acting. Perhaps, using other types of more objective measures, which assess the student's action with respect to each of the intelligences, other results might be obtained, different from those presented here (Ekinci, 2014).

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