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Creativity development trajectories in Elementary Education: Differences in divergent and evaluative skills

1. Introduction

Creative skills are particularly relevant in the early years, specifically during Elementary Education. Today, now that previous reductionist visions have been superseded, we understand that creativity is a complex reality, in which a multitude of genetic, psychological and cultural factors interact. Every human being has a creative potential which he will develop to a greater or lesser degree. Understanding how said development takes place seems to be a fundamental aim, since we understand increasingly more clearly the close relationship between creative development and personal well-being (Csikszentmihalyi, 1990; Richards, 2007).

There have been many studies on the creativity development in childhood, but the results are not yet conclusive. Different studies indicate increases in creativity related to age (e.g. Besançon & Lubart, 2008; Chae, 2003; Maker, Jo, & Muammar, 2008; Mouchiroud & Lubart, 2002; Smith & Carlsson, 1983). From this perspective, it is considered that older children are more creative basically because creativity grows through experience and knowledge. Other studies, however, indicate various critical descents during childhood.

Most studies have focussed on the descent at 5 years of age (Torrance, 1962; Urban, 1991) and the so-called “fourth-grade slump” (Torrance, 1968). Other studies have found reductions in the development of childhood creativity between the ages of 6 and 8 (Smith & Carlsson, 1983, 1985, 1990) and 8 and 10 (Lubart & Lautrey, 1995). In this regard, it is felt that the descent can be explained by the influence of both internal factors (e.g. the cognitive development means that childhood thinking becomes progressively more logical and conventional, certain personality characteristics such as

low tolerance of risk and error may block creativity...) and external factors (e.g. exposure to a rigid and structured school environment, peer pressure to conform).

Understanding creativity development becomes more complex if we take into account the results of research that study the pattern said development follows. The proposals are, again very varied. From studies which propose ascendant linear development (Lau & Cheung, 2010; Mullineaux & Dilalla, 2009); those which propose a J-shaped relationship between the ages of 6 and 20 (Smolucha and Smolucha, 1985); a U-shaped relationship between 6 and 12 (Gardner, 1987; Rosenblatt & Winner, 1988), or between 3 and 6 years of age (Daugherty, 1993), or between fourth and sixth grade (Runco, 1991); or an inverted U-shaped relationship from first to fifth grade (Besançon & Lubart, 2008).

There may be various explanations for the diversity of results reported on the creativity development trajectories:

- a) Studies carried out with reduced samples which are not very representative.
- b) Studies which include relatively narrow age ranges covering only two or three school years or ages. Similarities between the levels may make the developmental trajectories discovered unstable (Lau & Cheung, 2010).
- c) Confusion in the procedures and criteria used to assess creativity. The assessment of creative skills has been carried out focussing attention almost exclusively on the creative product, ignoring the process. Creativity has usually been evaluated with verbal and non-verbal divergent thinking tasks (Mullineaux & Dilalla, 2009). These tasks tend to pose "well-defined" initial situations and ask the subjects to produce as many ideas as they can within a specific time limit. However, in order to assess creativity it is preferable to use "ill-defined" problems in which the subject does not only give ideas to resolve the situation but also identifies and defines the problem in a personal way

(Wakefield, 1991). Finding a problem and defining it is already creative behaviour (Sternberg, 1988; Runco, 1994). In these terms, the model which has best defined and implemented the process of creative thinking is Getzels and Csikszentmihalyi's (1976) "problem finding" model. It is important to bear in mind not only the characteristics of the ideas or products that the subjects are capable of proposing but also the process by which they have arrived at said ideas.

d) Some studies identify divergent thinking with creative thinking. Although one of the most commonly recognised components of the creative phenomenon, is divergent thinking, it does, however, involve more than divergence. Divergent thinking facilitates the generation of ideas and helps to fulfil the criteria of originality of the creative response. But without a certain degree of adaptation to the environment in which the response is given, novelty alone is not identified with creativity. Evaluative thinking also plays a fundamental role in the creative process, permitting not only original but also appropriate responses. Creativity, therefore, is a process in which both divergent and evaluative skills participate, and both have a greater or lesser importance depending on when the creative process takes place.

It is understandable that the studies that focus on divergent variables report developmental trajectories different to those described in studies that take into account evaluative variables, such as the reorganisation of information or re definition of problems (Lubart, Mouchiroud, Tordjman, and Zenasni, 2003). Charles and Runco (2001) analysed the developmental trajectory of the evaluative component of creativity reporting a positive relationship with age, with no significant descents. Therefore, age and the corresponding gain in experience and knowledge, may mean greater possibilities of control and planning of one's own creativity, being of benefit to the evaluative skills. Runco (1991) suggests that it is possible that the descents in divergent

thinking during childhood are related to an increase in evaluative skills. Along these lines, Gardner (1987) also postulates that the elementary stage of schooling is a "literal stage" in which the child gains experiences such as the incorporation of rules and regulatory knowledge and the loss of his metaphorical thinking and tolerance of fantasy. "Children become sensitive to aesthetic aspects just at the same time in which their own work, in many cases, seems to become less interesting" (Gardner, 1987; p. 119).

Divergent thinking may also benefit from the gain of experiences, knowledge and resources (greater imaginative potential, greater expressive resources, etc.) but probably experiences greater instability and generates greater individual differences in children. We consider that the improvement in the evaluative creativity variables may have a regulatory character whereas in the divergent variables the changes may be more sensitive to motivational-attitudinal factors and be responsible for the significant descents traditionally found in the literature on creativity development.

1.1 Creativity and gender

Many studies have not found gender differences in creativity. Those that have found such differences have not found a consistent pattern (Baer & Kaufman, 2008). For example, a repeated finding has been that girls have higher scores in verbal creativity and boys in figurative creativity (DeMoss, Milich, and DeMers, 1993; Fichnova, 2002). However, there are studies with different results (Chan et al., 2001; Dudek, Strobel, and Runco, 1993). Alfonso-Benlliure and Valadez (2013) found significant differences in creativity when it was assessed subjectively (teachers gave girls higher scores whereas colleagues gave higher scores to boys) but such differences were neutralised when the assessment was objective (creativity test). For their part, Urban (1991), with children between the ages of 4 and 8, found slight differences in favour of boys at 5 years old and girls at 6, but neither were significant. In Mulineaux and Dilalla's (2009) study, girls

had significantly higher scores than boys in Creative Thinking-Drawing Production (TCT-DP, Urban & Jellen, 1986) indicating that their products were more elaborated and well executed in the age span between 10 and 15. Lau and Cheung (2010) found that from fourth to sixth grade, boys had higher scores than girls, but the differences were marginal. As we can see, the question of differences of gender in creative production still presents ambivalent results and is far from being resolved.

In synthesis, the Elementary Education stage is considered by some authors to be a sensitive period in creativity development (e.g. Gardner, 1987; Hébert, 1993). In such a way, this period could be a bridge between childhood creativity, spontaneous, not highly controlled and naïve, and adult creativity, more elaborate, purposeful and complex. Prior research has not reached a consensus on whether age and gender are related to creativity although there does seem to exist a certain agreement on considering that creativity development in childhood advances parallel to the rest of the dimensions of childhood development following a basically ascendant trajectory (Sawyer, 2012). Although various studies have identified them, it is very likely that the crises in creativity development are not regulatory.

Finally, Amabile (1996) suggested that both “domain-relevant skills” and “creativity-relevant skills” are necessary for creative performance. Domain-relevant skills can be considered the basis for performance in a particular domain. Meanwhile, creativity-relevant skills are used across domains. Kaufman and Baer (2005) proposed a hierarchical model of creativity that integrates both domain-general and domain-specific elements on four levels: initial requirements, general thematic areas, domains, and micro-domains. This sort of fusion is perhaps the most likely eventual solution to the question of domain specificity (Baer, 2010). The present study includes visual art as general artistic area, and drawing as a specific subdomain. Drawing is a universal

language of children and its use has been widely recommended as a means of assessment (Driessnack, 2005). The acquisition of “creativity relevant skills” is especially important during childhood and children's drawings can be used to assess these skills.

The aim of this paper is to analyse the creativity development trajectory in the age range from 6 to 12 years, taking into account both the creative product and the process and studying separately the developmental trajectories of divergent and evaluative variables. Finally, we also wish to observe whether the possible differences in said variables are not only associated to age but also to gender. It is therefore hypothesised that:

- The developmental trajectory of global creativity and that of the evaluative variables is basically ascendant, with no significant descents (H1 and H2).
- The developmental trajectories of the divergent variables have a more irregular and less homogeneous character (H3). The divergent variables strongly influenced by personal attitudes and motivations have a trajectory with significant descents. However, the divergent variables strongly influenced by experiences and knowledge have an upward trajectory.
- Significant differences in Creativity between boys and girls do not exist but do exist in developmental trajectories of determined variables of a divergent character (H4).

2. Method

2.1 Participants

The total number of participants were 1491 pupils from Elementary Education. 55.7% were boys and the remaining 44.3% girls, originating from a total of seven schools, both state and subsidised. The schools were located in the autonomous

communities of Madrid and Valencia (Spain). All the schools had an average socio-cultural level. The distribution by school year was homogeneous, with more students from second grade (18% in total), and with the least number of students from fifth grade (14.9%). Three of the schools had more than one group per school year. In these cases, the groups with greater homogeneity with respect to gender and age were chosen.

2.2 Instruments

Test de Creatividad Infantil (TCI) (Child Creativity Test) (Romo, Alfonso-Benlliure and Sánchez-Ruiz, 2008). It assesses childhood creativity based on the planning and execution of a drawing. It takes as a theoretical point of reference the *Problem Finding* model of Getzels and Csikszentmihalyi (1976) based on the idea that the most important characteristic in the creative solution of problems is the formulation of an appropriate question. In their original work, Csikszentmihalyi and Getzels (1971) asked their art students to produce a drawing under initially constant conditions: twenty-seven objects were placed on a table and each subject was asked to set up on a second table a composition that suited him with any of the available objects. He was then to work on a drawing until he felt that it was completed, using a variety of dry media that were also made available. There is some evidence that the quality of artwork is predictable to an extent from the exploratory behavior in which the artist engage before doing their more explicitly creative work (Csikszentmihalyi and Getzels, 1971; Kay, 1991). TCI captures this problem finding process, adapted for a child population, and assesses process as well as final product variables.

The TCI assesses the pictorial creativity of children in Elementary Education in two phases: Firstly, the formulation of the problem, consists in elaborating a model or drawing project. Each child is given a sheet of: twenty-eight stickers and freely selects those he wishes to use to produce his project. Two variables are assessed during this

phase: Originality (how infrequently the stickers chosen to do the project were selected according to gender and age) and Atypical Manipulation (exploratory behavior with the stickers). Both variables aim to capture certain characteristics of the creative process and tap divergent thinking.

In the second phase, that of resolving the problem, the child produces a drawing based on his initial model, with total creative freedom. The variables assessed during this second phase are: Changing Materials (using more than one material to create the drawing), Interaction (clear, intentional relationship between two or more elements in the drawing), Verbal Elements (accompanying the drawing with titles, dialog boxes, numbers, acronyms, etc.) and Making up Figures (how many figures appear in the drawing but neither the model nor the stickers the child was given). All of these are assessed on the final drawing produced by the child. Changing Materials and Interaction are evaluative variables. Verbal Elements and Making up Figures are divergent variables.

Table 1: Classification of TCI's variables

Reliance on...	Divergent thinking	Evaluative thinking
Experience & Knowledge	Verbal Elements	Changing Materials
	Making up Figures	Interaction
Attitude & Motivation	Originality	
	Atypical Manipulation	
	Departure from the Model	

Finally, the variable Departure from the Model (the drawing takes on new structure and meaning from the original model) responds to the creative process and is of a divergent nature. The divergent variables Making up Figures and Verbal Elements based on imagination and language have a strong structural weight and are linked to the acquisition of experiences and knowledge. The divergent variables Atypical

Manipulation, Departure from the Model and Originality are based on the relationship that the subject establishes with the task required, and have a strong motivational-attitudinal weight.

Some variables are dichotomous (Atypical Manipulation, Changing Materials, Interaction, Verbal Elements and Departure from the Model). The others are continuous variables (Originality and Making up Figures). The Global Creativity variable was implemented with the total score of the TCI which oscillates between 0 and 12. The test's Interclass Correlation Coefficient, according to the manual, is .80. The TCI was validated based on the expert evaluation by judges using the Consensual Technique for Creativity Assessment (Amabile, 1983, 1996).

2.3 Procedure

The children participating in the study filled in the TCI. The administration of this instrument was collective. It was administered by school year and schools (a total of 42 passes, in an ordinary classroom during school hours). In each of them, a minimum of two people performed the evaluation: The duration of the test varied between 45 and 60 minutes in function of the groups. Generally, the lower school years took longer to complete the task. As the test manual suggests, the general instructions were communicated to the group and adjusted to the comprehension capacity of each age group. Personal doubts were resolved individually in order not to contaminate the results. The administration of the tests in the seven participating schools took place in an interval of time of approximately one month.

2.4. Statistical analysis

A series of MANOVAs were conducted to analyse the differences in creativity between school years and gender. In the first place, the school year and gender were considered as grouping variables and the three quantitative measures of creativity

(Originality, Making up Figures and Global Creativity) were considered dependent variables. Afterwards, the analyses were repeated separately for boys and girls.

Finally, in order to analyse the differences by school year and gender between the dichotomous variables of the TCI (Atypical Manipulation, Changing Materials, Interaction, Departure from the Model and Verbal Elements) the contingency tables and the calculation of the phi (Φ) coefficient and the Cramer's V coefficient were used, depending on which corresponded. Again, the analyses were first carried out with the group of participants and later independently by gender.

3. Results

The multi varied contrasts of the first MANOVA showed significant differences by years ($\lambda = .95$, $F_{(3, 15)} = 4.95$, $p < .01$, $\eta^2_{\text{partial}} = .016$), gender ($\lambda = .88$, $F_{(3, 15)} = 69.85$, $p < .01$, $\eta^2_{\text{partial}} = .124$) and in the school year-gender interaction ($\lambda = .92$, $F_{(3, 15)} = 8.03$, $p < .01$, $\eta^2_{\text{partial}} = .026$). The uni varied contrasts showed statistically significant differences in Global Creativity by school years ($F_{(15, 1490)} = 4.73$; $p < .01$, $\eta^2_{\text{partial}} = .016$) and gender ($F_{(15, 1490)} = 13.83$; $p < .01$, $\eta^2_{\text{partial}} = .009$). We also found significant differences in Making up Figures by school years ($F_{(15, 1490)} = 4.41$; $p < .01$, $\eta^2_{\text{partial}} = .015$) and gender ($F_{(15, 1490)} = 4.48$; $p < .05$, $\eta^2_{\text{partial}} = .003$). Finally, the differences were also significant in Originality both by years ($F_{(15, 1490)} = 8.40$; $p < .01$, $\eta^2_{\text{partial}} = .015$) and gender ($F_{(15, 1490)} = 202.18$; $p < .01$, $\eta^2_{\text{partial}} = .120$) and in Interaction ($F_{(15, 1490)} = 21.57$; $p < .01$, $\eta^2_{\text{partial}} = .068$).

Table 2: Significant differences between grades in global TCI and its quantitative variables.

	TCI						ORIGINALITY				MAKING UP FIGURES			
	Grade 4		Grade 5		Grade 6		Grade 5		Grade 6		Grade 5		Grade 6	
	M.D	p	M.D	p	M.D	p	M.D	p	M.D	p	M.D	p	M.D	p
Grade 1	-.726	.014	-.907	.001	-.718	.016	-.027	.006			-.083	.001	-.073	.004
Grade 2			-.659	.045										
Grade 4							-.034	.000	.035	.000				

M.D = Mean differences . p = Level of significance.

The post hoc tests of multiple Tukey (DHS) comparisons enable us to look deeper into the differences by school year. Table 2 shows the differences by school year in Global Creativity (TCI) Making up Figures and Originality variables (see Table 2). The significant differences between boys and girls are found in the third and fourth grades, always in favour of the boys. We will look more closely at the results regarding the differences between boys and girls in later sections.

Contingency tables enable us to compare the differences by school year and gender in the dichotomous variables of the TCI. With respect to school year, we observe significant differences in four of the five variables: Changing Materials $\chi^2(5) = 23,80$, $p = .000$, Cramer's $V = .126$; Interaction $\chi^2(5) = 22,68$, $p = .000$, Cramer's $V = .123$; Verbal Elements $\chi^2(5) = 34,86$, $p = .000$, Cramer's $V = .153$; and Departure from the Model $\chi^2(5) = 13,64$, $p = .018$, Cramer's $V = .096$. No differences were observed by school year in the Atypical Manipulation variable $\chi^2(5) = 1,52$, $p = .911$, Cramer's $V = .032$.

Table 3: Significant differences between grades in TCI qualitative variables.

CHANGING MATERIALS				INTERACTION				VERBAL ELEMENTS				DEPART. M.	
Grade 5		Grade 6		Grade 4		Grade 6		Grade 1		Grade 2		Grade 6	
P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ
Grade 1				-14.9	12.94 .000 .161	-13.4	10.61 .001 .146						
Grade 2		13.3	11.13 .001 .144	-13.7	11.65 .001 .148	-12.2	9.36 .003 .132					-11.4	9.45 .002 .133
Grade 3	-13.9	10.95 .001 .155						12.4	14.79 .000 .178				
Grade 4								15.6	22.18 .000 .210	11.8	12.59 .000 .154	-10.6	7.90 .005 .122
Grade 5		16.9	16.43 .000 .183					13.1	15.82 .000 .186				
Grade 6								14.8	2050 .000 .202	11	11.22 .001 .145		

P.D = Percentage difference; χ^2 = Chi-squared; p = level of significance; Φ = phi coefficient.

With the aim of finding out between which school years the most significant differences occur, we repeated the analysis comparing the courses two by two. In Table 2 we can observe between which school years these differences take place.

With respect to gender, we also observe significant differences in the same four variables: In Table 4 we can observe between which school years these differences take place.

Table 4: Total percentages by gender and course in the dichotomised variables. Significant differences by gender.

	<u>Grade 1</u>		<u>Grade 2</u>		<u>Grade 3</u>		<u>Grade 4</u>		<u>Grade 5</u>		<u>Grade 6</u>	
	%	χ^2	%	χ^2 /p/ Φ	%	χ^2 /p/ Φ	%	χ^2 /p/ Φ	%	χ^2 /p/ Φ	%	χ^2 /p/ Φ
M.A.												
Total	20.4		21.6		22.6		24.4		23.9		22.2	
Girls	18		17.4		18.9		21.7		26.7		21.8	
Boys	22.2		24.8		25.2		26.5		20.8		22.4	
Ch. Mat.												
Total	67.7		75.7		65.4		71.1		79.3	4.01	62.4	
Girls	73		80		70		72.2		84.5	.049	64.7	
Boys	63.7		72.5		61.9		70.2		73.6	.134	60.5	
INTERACTION												
Total	23.4		24.6	4.40	33.3		38.3	4.24	31.5		36.8	6.33
Girls	19		18.3	.036	29.5		31.3	.042	31.9		28.6	.015
Boys	26.7		29.4	.128	36		43.7	.126	31.1		43.5	.154
Verbal E.												
Total	8.1		11.9		20.5		23.7	7.23	21.2		22.9	
Girls	6		8.7		18.9		15.7	.009	19.8		19.3	
Boys	9.6		14.4		21.6		29.8	.165	22.6		25.9	
DEPART. M.												
Total	23	4.79	18.7	7.17	25.2		19.5		26.6		30.1	4.39
Girls	16	.029	11.3	.007	20		13.9		26.7		23.5	.044
Boys	28.1	.143	24.2	.164	28.8		23.8		26.4		35.4	.128

χ^2 : chi-squared; p: level of significance; Φ : Phi coefficient. * significant difference a $p < .01$; ** significant difference a $p < .05$

3.1 Boy's developmental trajectories

With the aim of proving whether the qualitative leaps coincide over time we repeated the MANOVA and the contingency tables separately with girls and boys. Amongst the boys, the new multi-varied contrasts also show significant differences by school year ($\lambda = .91$, $F_{(3, 15)} = 5.23$, $p < .05$, $\eta^2_{\text{partial}} = .031$) whereas the uni varied contrasts show that these differences were statistically significant in Global Creativity ($F_{(5, 831)} = 2.32$; $p < .05$).

.05, $\eta^2_{\text{partial}} = .014$), in Originality ($F_{(5, 831)} = 11,75$; $p < .01$, $\eta^2_{\text{partial}} = .066$) but only marginally significant in Making up Figures ($F_{(5, 831)} = 2,16$; $p = .057$, $\eta^2_{\text{partial}} = .013$).

Table 5: Means and standard deviation of global TCI and its quantitative variables for grade 1 to grade 6.

	<u>Grade 1</u>		<u>Grade 2</u>		<u>Grade 3</u>		<u>Grade 4</u>		<u>Grade 5</u>		<u>Grade 6</u>	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
TCI												
Total	3.63	2.35	3.88	2.21	4.18	2.69	4.53	2.40	4.53	2.55	4.35	2.54
Girls	3.35	1.96	3.48	1.87	3.95	2.68	3.82	2.21	4.67	2.46	4	2.18
Boys	3.83	2.58	4.18	2.40	4.35	2.71	4.76	2.47	4.38	2.65	4.63	2.78
M. up Fig.												
Total	.16	.21	.20	.21	.21	.22	.21	.22	.25	.23	.24	.24
Girls	.13	.16	.17	.21	.23	.23	.19	.22	.25	.21	.20	.20
Boys	.19	.24	.21	.22	.19	.23	.22	.22	.25	.26	.26	.26
ORIGINALITY												
Total	.61	.07	.63	.11	.62	.08	.61	.11	.64	.08	.61	.07
Girls	.59	.08	.59	.13	.56	.08	.53	.10	.63	.07	.60	.08
Boys	.63	.05	.65	.08	.66	.06	.66	.07	.65	.09	.61	.06

** : Significant differences between boys and girls (Grade 3: $F(1, 234) = 112,72$, $p < .01$, $\eta^2_{\text{partial}} = .327$; Grade 4: $F(1, 266) = 153,68$, $p < .01$, $\eta^2_{\text{partial}} = .368$).

The post-hoc analyses show that the differences between school years in Global Creativity only occur between first and fourth grade. For their part, the differences in Originality occur between the sixth grade and all the other grades and between years first-third and first-fourth (see table 6).

Table 6: Significant differences between grades in boys global TCI and its quantitative variables.

	TCI				ORIGINALITY							
	<u>Grade 4</u>		<u>Grade 1</u>		<u>Grade 2</u>		<u>Grade 3</u>		<u>Grade 4</u>		<u>Grade 5</u>	
	M.D	p	M.D	p	M.D	p	M.D	p	M.D	p	M.D	p
Grade 1	-.932	.030					-.025	.041	-.029	.007		
Grade 6			-.025	.042	-.045	.000	-.050	.000	.054	.000	-.038	.000

M.D = Mean differences . p = Level of significance.

Amongst the dichotomous variables we find significant differences between males by school year in two variables: Interaction $\chi^2(5) = 16,59$, $p = .005$, Cramer's $V = .141$ and Verbal Elements $\chi^2(5) = 24,11$, $p = .000$, Cramer's $V = .170$. In Table 6 we can observe between which school years these differences take place.

Table 7: Significant differences between grades in boys TCI qualitative variables.

	INTERACTION				VERBAL ELEMENTS			
	Grade 4		Grade 6		Grade 1		Grade 2	
	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ
Grade 1	-17	9.02 .003 .178	-16.8	8.75 .003 .176				
Grade 2	-14.3	6.70 .010 .148	-14.1	6.47 .011 .147				
Grade 3					12	7.40 .007 .164		
Grade 4					20.2	17.94 .000 .250	15.4	10.52 .001 .186
Grade 5	-12.6	4.16 .041 -.127	-12.4	4.01 .045 .126	13	7.74 .005 .179		
Grade 6					16.3	12.50 .000 .211	11.5	6.17 .013 .143

P.D = Percentage difference; χ^2 = Chi-squared; p = level of significance; Φ = phi coefficient.

3.2 Girls' developmental trajectories

With respect to the girls, the multi-varied contrasts of the MANOVA were also significant ($\lambda = .85$, $F_{(3, 15)} = 8.52$, $p < .01$, $\eta^2_{\text{partial}} = .052$). The differences were significant in the three variables: Global Creativity ($F_{(5, 660)} = 4.88$; $p < .01$, $\eta^2_{\text{partial}} = .036$), Originality ($F_{(5, 83)} = 15.95$; $p < .01$, $\eta^2_{\text{partial}} = .109$) and Making up Figures ($F_{(5, 660)} = 4.32$; $p < .05$, $\eta^2_{\text{partial}} = .032$). Table 7 shows the differences between school years for each of the variables.

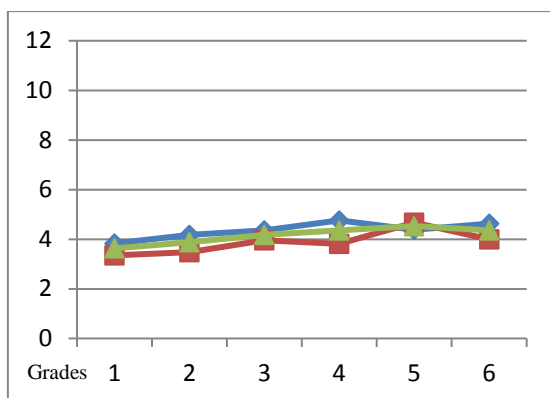
Table 8: Significant differences between grades in boys global TCI and its quantitative variables.

	TCI		ORIGINALITY				MAKING UP FIGURES			
	Grade 5		Grade 4		Grade 5		Grade 6		Grade 3	
	M.D	p	M.D	p	M.D	p	M.D	p	M.D	p
Grade 1	-1,320	.000	.054	.000	-.049	.002			-.101	.009
Grade 2	-1,206	.001	.058	.000	-.045	.004				
Grade 3					-.074	.000	-.040	.027		
Grade 4	-.867	.043			-.103	.000	-.069	.000		

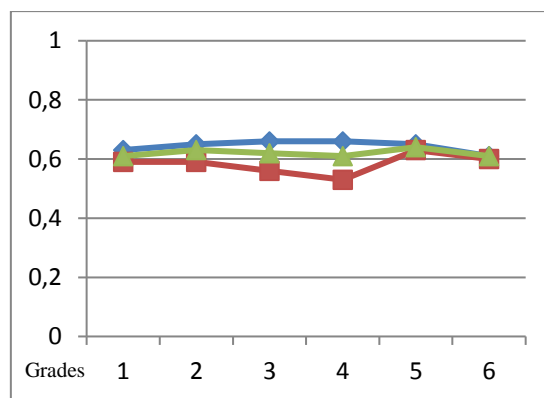
M.D = Mean differences . p = Level of significance.

Figures 1 to 8: TCI's scores among different graders

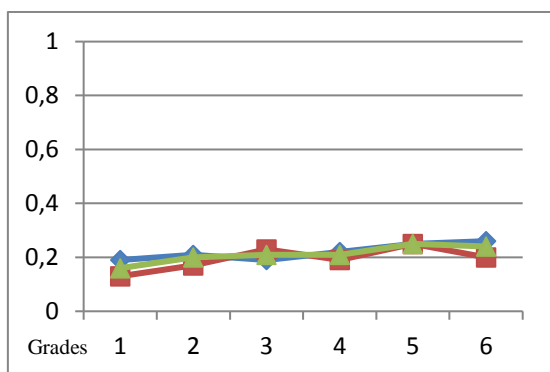
■ : Girls ◆ : Boys ▲ : Total



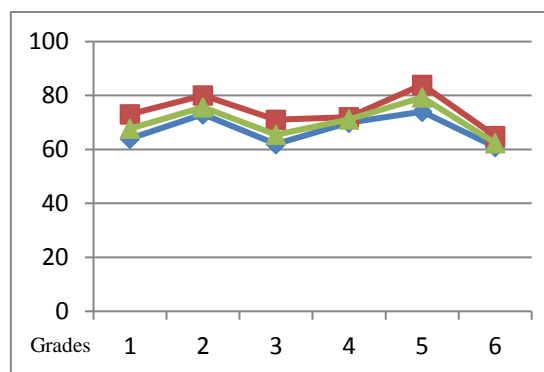
1. Global Creativity



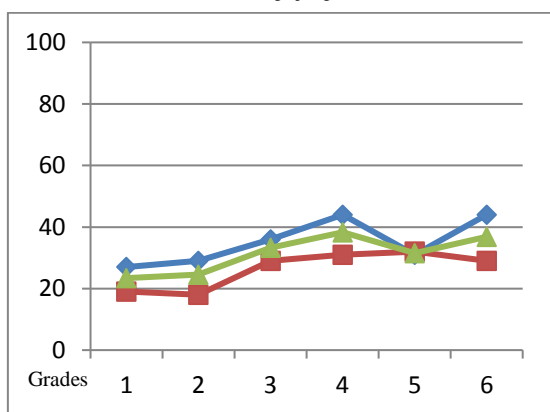
2. Originality



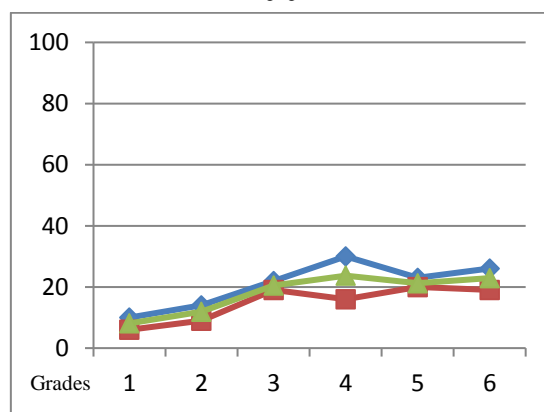
3. Making up Figures



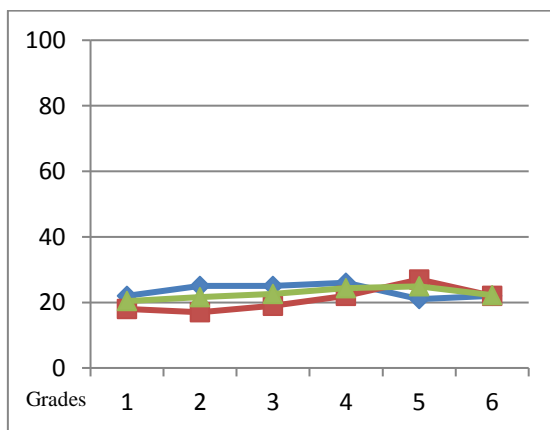
4. Changing Materials



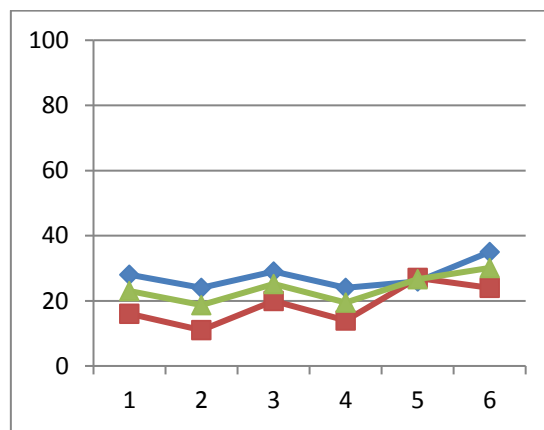
5. Interaction



6. Verbal Elements



7. Atypical Manipulation



8.- Departure from the Model

Among the dichotomous variables we find significant differences between girls by school year in Changing Materials $\chi^2 (5) = 4,08$, $p = .010$, Cramer's $V = .151$; Verbal Elements $\chi^2 (5) = 15,02$, $p = .010$, Cramer's $V = .151$; and Departure from the Model $\chi^2 (5) = 13,23$, $p = .021$, Cramer's $V = .142$. The differences are only marginal in Interaction $\chi^2 (5) = 10,68$, $p = .058$, Cramer's $V = .127$. The differences are not significant in Atypical Manipulation $\chi^2 (5) = 4,08$, $p = .538$, Cramer's $V = .079$. Table 9 shows the specific differences by school year. Figures 1 to 8 visually express the developmental trajectories of each of the variables, both for the whole group of students and separated by gender.

Table 9: Significant differences between grades in boys TCI qualitative variables.

	CHANGING MATERIALS				VERBAL ELEMENTS				D. FROM THE MODEL			
	Grade 5		Grade 6		Grade 1		Grade 2		Grade 5		Grade 6	
	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ	P.D	χ^2 /p/ Φ
Grade 1	-11.	4.29 .038 .141										
Grade 2			15.3	6.82 .009 -.171					-15.4	8.91 .003 .196	-12.2	6.05 .014 .161
Grade 3	-14	5.97 .015 .168			12.9	7.57 .006 .197	10.2	4.73 .030 .150				
Grade 4	-12.3	5.16 .023 .149			9.7	5.03 .025 .153			-12.8	5.84 .016 .159		
Grade 5			19.8	12.08 .001 -.227	13.8	8.83 .003 .202	11.1	5.84 .016 .159				
Grade 6					13.3	8.40 .004 .196	10.6	5.46 .019 .153				

P.D = Percentage difference; χ^2 = Chi-squared; p = level of significance; Φ = phi coefficient.

4. Discussion

This study aims to analyse the different developmental trajectories of the divergent and evaluative variables which are the basis of creative thinking and to check the differences according to gender. Given the complexity of the creative phenomenon and the multiplicity of results on the developmental trajectory and its development in childhood, our results throw some light on the development of the different variables

involved in the creative process. The results confirm some hypotheses and lead us to refine others.

We hypothesised that we would find different trajectories depending on the different types of variables. With respect to Global Creativity, as we hypothesised, it has shown an ascendant developmental trend throughout the years of Elementary Education. Other authors found ascendant trajectories of creativity (e.g. Besançon & Lubart, 2008; Chae, 2003; Maker, Jo, & Muammar, 2008; Mouchiroud & Lubart, 2002; Smith & Carlsson, 1983) confirming the trend that establishes that significant slumps in creativity are not normative and that creativity increases throughout childhood show an arrhythmic pattern.

It was hypothesised that the developmental trajectory of the evaluative variables would basically ascendant. This has been confirmed in the case of Interaction but not in the case of Changing Materials. It was hypothesised that divergent variables strongly influenced by experiences and knowledge have an upward trajectory. Verbal Elements and Making up Figures confirmed it. Finally, it was expected that divergent variables strongly influenced by personal attitudes and motivations have a trajectory with significant descents and ascents. This has been confirmed in the case of Originality but not in the case of Atypical Manipulation. Below we discuss the results in more detail.

Our paper has identified three types of trajectories: a.- Ascendant Trajectory ; b.- Trajectory with ups and downs; and c.- Stable Trajectory .

a.- Ascendant Trajectory. This pattern is characterised by the absence of significant descents, which was expected in the evaluative variables and also, in determined divergent variables in which knowledge and experience are heavily weighted.

The evaluative variable Interaction confirms what was expected as the production charts for children showed an increase linked to age in the interconnection of the figures

and the complexity of the composition carried out. Supported fundamentally by intellectual development, the creative process is nurtured by increasingly more precise representations of reality and of more operative references when evaluating personal productions. Children are increasingly more conscious of which ideas others may think of, of their expectations and which ideas seem more appropriate (Charles & Runco, 2001). In this way, the drawings aim to portray a truer depiction of an agreed reality (e.g. the horizon, the most conventional spatial relationships) and incorporate more links and interactions between the elements and figures depicted. Urban (2004), based on his developmental study with the Test for Creative Thinking-Drawing Production (TCT-DP), states that the highest level of creativity development is that which is manifested in drawings characterised by holistic compositions. In said compositions, the elements and figures contribute to granting a meaning which is expressed by the holistic way of formal figural quality of the drawing.

The divergent variables Making up Figures and Verbal Elements were also aligned to the hypothesis. The development of the Making up Figures variable is closely linked to the development of the imagination. The imaginative potential increases with age since it feeds on learning and knowledge. Recent research shows a positive and significant relationship between the disposition to imagine and fantasize and determined areas of development, in particular those related to cognitive development and academic success (Smith & Mathur, 2009). Mouchiroud and Lubart (2002) also found that the number of ideas generated (fluency) for creativity tasks increased as a function of age level.

Alfonso-Benlliure & Valadez (2013) found that, from amongst a wide range of extra-curricular interests, that which best predicted the amount of creative responses from children in Elementary Education was the interest in spending time “imagining”. The ability to imagine and to reproduce invented figures in their work increases with age and

reflects the tendency to express one's own way of viewing the world and manifesting one's own individuality.

The Verbal Elements variable shows the desire of the child to use different means of expressions, transcending graphic language and complementing with linguistic messages. Between the ages of 6 and 11 years old, verbal skills play a role which gradually becomes more crucial in their intellectual and creative development.

Language mediates between the child and his exterior reality and extends the capacity for action on said reality. Said mediation allows for symbolic thinking, self-regulation, taking perspective, etc., which has an influence on the creative process and improves the child's possibilities of expression. The results of this study highlight the increasing need for children to reflect their interior world in a fuller way in their work, adding verbal messages to their drawings which complement and, to a degree, support the act of communication. The gradual increase of written messages in combination with pictorial messages is linked to the importance that language acquires throughout childhood as a regulatory instrument of thought and action and probably, also with the construction of a social identity and the need to "confirm communication".

Finally, and contrary to what was expected, the Departure from the Model variable also showed an ascendant trajectory. This variable was initially classified in the divergent group as it reflects the tendency of children to look for new options and not stick with the first of the acceptable solutions which appear in the creative process. However, the developmental trajectory found indicates the need to go deeper into the nature of this variable and the reflection that we had perhaps undervalued its complexity. Departing from initial ideas also means reviewing one's own processes of thinking, doubt, and rectification and, therefore, putting evaluative skills into practice. Skills of self-observation and review are closely linked to the executive functions

associated to control and regulation of the cognitive function applied to learning and the creative resolution of problems. This implies meta-components such as the redefinition of problems, the formulation of strategies or the mental representation of solutions (Sternberg, 1985) closely linked to intellectual development. Said meta-components appear to be present in this final phase of problem finding which is, in terms of Getzels' and Csikszentmihalyi's adopted model, the solution phase of the problem.

As a whole, the creative variables which have shown ascendant trajectories have the particularity of experiencing their main significant developmental leap in a scaled way: Verbal Elements do so in third grade, Interaction in fourth, Making up Figures in fifth and Departure from the Model in sixth. We observe, therefore, a global pattern between the ascendant patterns of the creative variables, characterised by a scaling in the acquisition of creative skills in childhood which could have a developmental meaning relating to a scheduled dosage of cognitive resources in the child.

b.- Trajectories with ups and downs. This developmental pattern is characterised by the presence of significant ascents and descents throughout school age and was expected for the divergent variables in which the attitudinal component has a relevant role.

The Originality variable has confirmed this expectation. Various studies have also found descents in creativity at the end of childhood and the pre-teen years (Lubart & Lautrey, 1995; Smith & Carlsson, 1990; Torrance, 1968). While the potential for being original increases with age, for the child to actually express said originality in his choices and products depends on his creative habits and his attitude towards his own creativity. His development with significant ascents and descents may be due to the complex interaction between the advances in self-affirmation, social presentation and personal communication on the one hand, and doubts in self-confidence and pressure to conform on the other. Csikszentmihalyi (1996) considered that a person has to

interiorize or assimilate the whole system which makes creativity possible in order to express it. Behind a new idea there is a divergent thinking, an idiosyncratic way of handling information and relating to it, which enables one to arrive at unusual ideas. During childhood, the need to discover oneself and communicate the interior world is greatly influenced by external factors which may counteract this natural tendency. The attitude that the child shows towards his own creativity and his convictions with respect to the norm have significant weight when swinging the balance in one direction or another. Many children end up taking refuge in the security that following social expectations affords. As we shall see in the section dedicated to the differences of gender, this pressure appears to affect girls at an earlier age. The final result is a more erratic developmental trajectory on which further and more detailed studies could be carried out, focussed on the direct influences on said ups and downs.

Contrary to what was expected, the Changing Materials variable also showed an up and down trajectory. Said variable shows the wealth of materials used to carry out the work and reflects the acquisition of skills to control quality and adaptation of the products. The results show non-significant ups and downs up until fourth grade, a significant ascent in fifth grade and an abrupt descent in sixth grade. In reality, in spite of slight initial hesitation, the developmental trajectory of this variable may be considered ascendant up to fifth grade. It is in sixth grade that this tendency is broken. What happened in sixth grade to produce such an abrupt descent? It does not seem likely that in sixth grade the skills linked to elaboration and perfectionism descend but rather that the expressive modality chosen to assess creativity affects the developmental trajectory of this variable. While the majority of smaller children are enthusiastic about drawing, it is often their preferred activity, the interest of older children in expressing themselves graphically is much more varied and, possibly, this affects their interest in

combining different types of materials when creating a drawing. In the last school year individual differences are evident in the preferences that children demonstrate for this and other means of expression. The variables linked to perfecting and the quality of personal creation only show an ascendant curve when the task to be executed is linked to personal interests. A more detailed analysis shows us that the significant descent only affects girls. Therefore, it would be necessary to analyse the developmental trajectory of this variable of elaboration diversifying the means of expression required.

c.- Stable Trajectory. This developmental pattern characterised by the absence both of significant ascents and descents has only occurred in the Atypical Manipulation variable. This variable refers to exploring and physically changing the stickers which breaks away from the conventional use of the same. There are models which explain the developmental process of manipulative action. Rossman (1964) proposes four types of manipulation in progressive development throughout infancy: (1) Exploration of the properties of the objects; (2) Deconstruction, combination and physical reorganisation of the objects, (3) Representational in which the manipulated objects stand for something other than that which is being manipulated; and (4) A type of manipulation in which the child mentally manipulates symbols and forms them into new patterns. Atypical Manipulation, as it was assessed in this study, makes reference to the modalities 2, 3 and 4 described by Rossman. The results show that simple forms of Atypical Manipulation already exist in small children. Since distinguishing between the different developmental modalities of Atypical Manipulation went beyond the aims of this study, the stable trajectory found highlights the need to assess these independently.

4.1 Differences between boys and girls

Previous studies of gender differences have revealed inconsistent findings. We postulated that there would not be significant differences in Global Creativity between

boys and girls. However, the results offer significant differences in Global Creativity in favour of boys. We suggested that some differences might exist between boys and girls, particularly in the variables of a divergent nature. The results show significant differences by years in all the variables except Atypical Manipulation. All the differences reflect higher scores for boys. In the first grade, in the Departure from the Model variable; in second grade, in this same variable and also in Interaction; in third grade, in Originality; in fourth grade, in Originality, Interaction and Verbal Elements. In fifth grade, we found the only exception: girls got higher scores for Changing Materials. In sixth grade, boys again scored higher in Interaction and Departure from the Model. Lau & Cheung (2010) also report differences in creativity in favour of boys in grades fourth, fifth and sixth, although these differences were only marginal. Studies with pre-school children (e.g. Fichnova, 2002) and adolescents (e.g. DeMoss, Milich, & DeMers, 1993) also showed these differences in figurative tasks.

Analysing the developmental trajectories of boys and girls separately, we discover that although there are no significant differences in the developmental pattern of Global Creativity (nor in others such as Changing Materials, Verbal Elements and Atypical Manipulation) there are some in the rest of the variables. In Departure from the Model, Making up Figures and Changing Materials, boy's developmental trajectories are more stable but those of the girls show some significant ascents and descents. This tendency is only broken by the Interaction variable in which the opposite occurs.

The developmental pattern which is most uneven between boys and girls occurs in the Originality variable. The trajectories drawn are almost an inverse reflection of each other. They are the same at the beginning and end of Elementary Education and pass through an intermediate trajectory (3rd and 4th) in which girls show less originality. When analysing the responses of boys and girls, Tegano and Moran (1989) also found

differences favourable to boys from third grade. The descent in originality of the responses of girls between the ages of 8 and 9 could be due to a greater pressure to conform and the assumption of more rigid social roles that they may receive.

In short, the trajectory which the developmental pattern describes for most of the variables is ascendant. These results support the idea that creativity development follows a parallel course to that of intellectual development and other developmental dimensions. Creative behaviour depends on the complex interaction between types of knowledge, the way they are manipulated (creative thinking) and a series of personal-affective influences which may ease or impede creativity (e.g. attitude, motivation, trust, tolerance to group pressure, etc.). The latter may give rise to a greater disparity between the subjects and have a significant responsibility in the descents in creative conduct and the unstable patterns in their development which has fundamentally affected the creative performance of girls.

However, this study does have various limitations. The most significant is its transversal nature. A longitudinal study would be desirable to discover the real trajectories of the boys in the age range of the groups analysed. On the other hand, it would be interesting to analyse general creativity and the variables which compose it through different modalities of expression, not only graphic but also verbal, musical, etc. These limitations serve as a reference to define the lines of future work: a longitudinal study in which creativity is assessed through different modalities of expression and with a more precise classification of the variables which make up the measures of creativity taking into account socio-affective variables (attitude, personality, etc.) and socio-cultural variables.

Further consideration needs to be given to knowledge of creativity development in childhood to find out its peculiarities and to be able carry out predictions on the

successful adaptation of children to several different environments at different points in their development. This knowledge may enable guided intervention to optimise the transition of the child through the most sensitive phase of creativity development, which is the period of Elementary Education.

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