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CREATIVITY, ART AND LATERALITY AS TOOLS FOR LEARNING THE LANGUAGE IN CHILDREN

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Abstract

The first years of life are fundamental because is the time where the bases are laid for the acquisition of cognitive skills, such as psychomotor, emotional and social abilities necessary for the proper learning. However, each day it is more common to find children in primary schools who suffer school failure. Behind this fact we find difficulties that have not been perceived in the first years of schooling, such as a poor integration of the body scheme and spatio-temporal orientation and a lack of definition in laterality. Different studies have shown that good laterality settlement can improve the literacy learning. Creativity, helps learning to be attached by a sense of pleasure which allows the development of cognitive, psychomotor, affective and social abilities in students. This study tests the influence of creativity, art and laterality in the learning of the language subject of 2nd grade children. 60 children have been gathered between the ages of 7 and 8 years old from Barcelona. The results of the investigation have shown that the defined laterality (right and left handed) favors the learning of the language subject to a greater extent than when it is crossed; meaning that academic performance is significantly higher when we have a defined laterality. In order to improve learning, an intervention is proposed to develop creativity and laterality, which is why this research has a preventive function of school failure.

Keywords: Creativity, art, laterality, language, learning, sex.

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1. Introduction

Different studies agree that there is a positive relationship between a good acquisition of the body scheme, whose fundamental axis is laterality and good school performance (Fonseca, 2000; Le Boulch, 1987). Studies also state that there is a correlation between defined laterality and good school performance (Berenguer, Llamas, & López, 2016; Ferré, Catalán, Casaprima, & Mombiela, 2000; Ferré & Ferré, 2010; Lobo, 2003, 2015; Mayolas, Villarroya, & Reverter, 2010; Mesonero, 1994). Moreover, Ferré and Aribau (2014), consider the lack of laterality not defined as a risk factor in the acquisition of learning, but also there must be other factors explored such as the appropriate psychomotor coordination, body scheme, stable rhythmic dynamics and communicative language. This research also aims to verify the importance of creativity in school learning, essentially in children throughout the cycle of kindergarten and primary school. Creativity is expressed spontaneously in children through multiple languages: play, music, singing, theatre, dance, stories ... and should be a first form of learning, before diving into tasks such as literacy and math which strongly needs a psychomotor maturation and a defined laterality to be able to develop satisfactorily. Currently creativity is a fundamental value to develop in the curriculum of our schoolchildren, and of course to take into account the way teachers and professors are teaching. “The human is not conditioned by external stimulation, but by the projects and goals he creates. It comes without programming and must be programmed to survive and that can be considered as the most significant creation exercise” (Vecina, 2006, pp. 32-33). Studies from the dissimilar fields such as psychology, pedagogy, medicine, anthropology agree that man is by nature a creative animal (Arieti, 1993; Gardner, 2010; Rendón, 2009; Winnicott, 1991). For this, learning, such as the organization of classrooms and school spaces, should not be chaired by a type of linear information processing, logical, rational, analytical, verbal, more similar to the left hemisphere, excluding global, artistic, creative, intuitive learning, chaired by the right hemisphere. This type of teaching would leave on inferior conditions those children who learn best in a creative and artistic way. Pascual-Leone, Amedi, Fregni, and Merabet (2005) Identifies creativity at the metaphorical or symbolic level with brain plasticity or neuroplasticity. “Brain plasticity is a dynamic capacity for change; or said in a more formal matter it is an emerging property of the neuron communication process that modulates the ways in which the brain perceives, learns or adapts.” A research hypothesis that arises is that creative people have greater plasticity. Different authors agree that there is a correlation between a good acquisition of the body scheme, whose fundamental axis is laterality and good school performance (Fonseca, 2000; Le Boulch, 1987). There are also studies in the literature stating that there is a correlation between defined laterality and good school performance (Ferré, Catalán, Casaprima, & Mombiela, 2000; Ferré & Ferré 2016; López & Llamas, 2015; Mayolas et al., 2010; Mesonero, 1994) and Ferré and Aribau (2014) consider the lack of undefined laterality as a risk factor in the acquisition of learning, although other factors such as adequate psychomotor coordination, body scheme, dynamics must also be explored. Stable rhythm and communicative language.

This research also aims to confirm the importance of creativity in school learning, essential in children throughout the entire child and primary cycle. Creativity is expressed spontaneously in children through multiple languages: play, music, singing, theatre, dance, plastic, stories ... and should be a first form of learning, before delving into tasks such as literacy and Mathematics that need a psychomotor maturation, a defined laterality to be able to develop satisfactorily. Currently creativity is a fundamental

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value to develop in the curriculum of our schoolchildren, and of course to take into account in the way of teaching teachers. “The human is not conditioned by external stimuli, but by the projects and goals he creates. It comes without programming and must be programmed to survive and that can be considered as the most significant creation exercise” (Vecina, 2006). The different studies developed by authors from the fields of psychology, pedagogy, medicine, anthropology agree that man is by nature a creative animal (Arieti, 1993; Chávez, Graff-Guerrero, García-Reyna, Vaugier, & Cruz-Fuentes, 2004; Gardner, 2010; Rendón, 2009; Winnicott, 1991). For this, learning, such as the organization of classrooms and school spaces, should not be chaired by a type of linear, logical, rational, analytical, verbal information processing, more similar to the left hemisphere, excluding global, artistic learning, creative, intuitive, chaired by the right hemisphere. This type of teaching would leave those children who learn best in a creative and artistic way. Pascual-Leone et al. (2005) identifies creativity at the metaphorical or symbolic level with brain plasticity or neuroplasticity. “Brain plasticity is a dynamic capacity for change; or more formally said, it is an emerging property of the neuron communication process that modulates the ways in which the brain perceives, learns or adapts”. A research hypothesis that arises is that creative people have greater plasticity. With all this in mind, this research aims to deepen the importance of creativity in school performance. I consider it essential that academic performance is accompanied by a sense of pleasure in knowledge and that allows the development of emotional, cognitive and psychomotor abilities in our children, abilities that are also necessary to develop as adults capable of creating their own lives and build a better world. This study examines the influence of laterality and creativity in the learning of the language subject.

1.1. Creativity and art

Art accompanies us on this journey inwards, towards our sensations, emotions ... by getting in touch with ourselves and with our life history in a fairly direct way. Art can also accompany us on the journey outward in expansion, as a form of positive expression, as a way to liberate and transform creatively. The expression of ourselves in this therapeutic and creative work can take any artistic medium as an expression channel (Moreno, 2009; Moreno & Ruiz, 2016). Arieti (1993) recognizes the immense complexity of the physiology and anatomy of the cerebral cortex and argues that the human brain is the only one that can be creative, due to its size and the number of neurons as fundamental requirements. Arieti (1993) was an advanced visionary of his time and recognizes the immense complexity of the physiology and anatomy of the cerebral cortex. It is proposed that the human brain is the only one that can be creative, due to its size and the number of neurons as fundamental requirements, it recovers the investigations of Sperry (1968), arriving at the belief that the left hemisphere tends to be atomistic in its functions, pain analytical, temperature, independent, symbolic, abstract, digital, secondary process. The law tends to be global, synthetic, perceptive, concrete, analogue, entity of the intensity of the primary process stimulus. Arieti (1993) based on these discoveries hypothesizes that both hemispheres - the right as the organ of the primary process and the left of the secondary - are necessary for creativity. Current investigations go in this direction.

On the other hand, Rendón (2009) provides some theories that try to relate creativity to brain structure, such as hemispheric lateralization, the triune brain theory of McLean (1978), total brain theory and the genetic evolution of the creative brain, but it Question what their origins were, how these functions

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evolved and where they are located. Carlsson, Wendt, and Risberg (2000) also studied the correlation between creativity, using a test designed by themselves (Creative Function Test), and cerebral blood flow. In his research, it was observed that the subjects with a higher creativity index showed an increase in bilateral frontal cerebral flow, while in those with less creativity, the cerebral flow showed activity of the left prefrontal cortex.

Moreover, research is found with slightly more cautious results, indicating that although the creative process involves the participation of multiple mental functions, the brain mechanisms of creativity are not yet known with precision (Escobar & Gomez-Gónzalez, 2006; Gándara, 2008). In addition, he considers that for the mind to get to work and the brain to apply itself to tasks, it is essential that "unconscious neural activity be pleasant and compensatory" and proposes a model of pleasant cerebral self-stimulation, focused on visual activities, which explains the process of pictorial artistic creativity.

1.2. Laterality

According to Portellano (2008), the body schema is a complex mental image of our body, which is produced through more or less conscious experience, while moving or in a static situation, which allows us to differentiate the limits of our environment, within coordinates defined topographic and spatial. There are a number of aspects to consider in the development and consolidation of the body scheme, which as Cañete (2010) states are the body domain (tone, posture, balance, and psychomotor coordination), breathing and relaxation, space structure -Timeral and laterality. Mayolas et al. (2010) highlights laterality as the compass of the body scheme. Lázaro and Berruezo (2009) consider laterality as the set of particular predominance of one or another symmetrical part of the body, at the level of hand, foot, eye, ear, adding the vestibule. Its development is connected with the organization of the body scheme and, on the other, with the concepts of space and time. Mayolas (2011) highlights its function with respect to the body scheme. For her, body laterality allows the organization of spatial references, orienting the body itself in space and objects with respect to the body itself. It facilitates therefore the processes of perceptual integration and the construction of the body scheme.

As Ferré and Aribau (2014) state, laterality begins to be activated from three to five years and develops from five to ten or twelve years. The laterality depends on the levels of prelateral development achieved. Before the laterality is defined, it is very important to have developed the contralateral connection pathways and to have activated the function of the corpus callosum, since for a hemisphere to be the director of a function, it must be well informed of what happens both in the whole of the system as in the other hemisphere, so as not to physically and mentally and emotionally interfere. The laterality can be: a) Defined, where there is use of the entire right side (eye, ear, right hand and foot), or left (eye, ear, hand and foot); b) Crusade, which is also divided into: 1) Ambidextrous: debate between one dominance or another; 2) Disharmonic left: the one who has preference for the use of the left part for some tasks and the right hand for others, depending on what you want to do; 3) Dystra disharmonic: it is the type of non-consistent lateralization, since the child uses both parts, although preferably the right. In addition, the inconsistency occurs because one or another part of the body is used depending on the different activities they carry out.

In 1710 Petit, cited by Edwards (1994), showed that there is a cross-linking of the motor pathways in the bulbar pyramids, confirming that motor control depended on the hemisphere opposite the innervated

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limb. In the nineteenth century it was confirmed through the contributions of Broca and Wernike with the location of the brain areas that regulated language. Roger Sperry and his disciples, Meyers and Trevarthen in 1968 (as cited in Edwards, 1994), discovered the communication of the two hemispheres through the corpus callosum, thus allowing the transmission of memory and learning. Levy (as cited in Edwards, 1994), showed that the mode of processing employed by the right hemisphere was rapid, complex, totalizing, spatial and perceptive and that the modalities of processing the information could interfere with each other, thus preventing optimal performance. This fact suggested the possibility that the asymmetric evolutionary development of the human brain was a way of maintaining the two different processing modes in two different hemispheres. These findings have been confirmed by current scientists such as Portellano (2008), Ortigosa (2004) and Ferré, et al., (2000). Similarly, Edwars (1994) states that our brain is double, and that each half has its own way of knowing, its own way of perceiving reality. Each of us has two minds, two consciousnesses, connected and integrated by the corpus callosum, a structure that serves as a mediator between both hemispheres. The hemispheres are able to collaborate and complement each other in many ways: "When the hemispheres collect the same sensory information, each one handles it differently. The left half analyzes, abstracts, counts, sets the pace, plans the procedures step by step, verbalizes and makes rational statements according to logic. For its part, the right hemisphere works through the intuitive, subjective, relational, holistic and time independent modality. We can understand metaphors, dream and create new combinations of ideas" Edwards (1994, p. 66).

There are authors such as Ferré and Aribau (2014) who oppose considering the left hemisphere as dominant and the right as subdominant, since the perception of any type of event needs an environment of global references that make sense. Thus, they state that:

> … Laterality is the result of the distribution of the functions of the two hemispheres and of the way in which the right and left hemisphere are distributed information processing. According to them, laterality has a relative value, not absolute, since in some phases of life, the right hemisphere and global processing dominate, and in others the right hemisphere takes control again. (p.101)

2. Problem Statement

Knowing the importance of emotion in cognitive learning and observing that for example creativity connects limbic (emotional) areas such as reptiles (instinctive) and cortical (cognitive), when performing a creative process, why not take advantage and offer both a creative and experiential learning that develops the knowledge and creativity of our children and the interest in learning?

3. Research Questions

Based on these arguments, we formulate the following hypotheses:

Hypothesis 1. The relationship between cross laterality will be negative with learning but not with creativity.

Hypothesis 2. The average in the learning of the defined lateralized participants (left-handed and right-handed) will be higher than in those with cross-laterality.

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Hypothesis 3. The relationship between creativity and learning will be different depending on the laterality and sex.

Hypothesis 3a. The relationship between creativity and learning will be different depending on the laterality (defined) and sex.

Hypothesis 3b. The relationship between creativity and learning will be different depending on the laterality (difficulty) and sex.

4. Purpose of the Study

The aim of this paper is to analyze the relationships between creativity, art and laterality on language learning moderated by sex.

5. Research Methods

5.1. Sample

60 children have been gathered between the ages of 7 and 8 years old (2nd grade of elementary school) from Barcelona. 24 participants were boys representing 40% of the sample and 36 were girls, representing 60% of the sample. We have found 5 children with left-handed laterality that represent 8.33% of the sample, 37 children with right-handed defined laterality representing 61.66% of the sample; 16 children with cross-laterality have been found that account for 26.66% of the sample, and finally 2 students with undefined laterality have been found, which represents 3.33% of the sample. From these data it appears that 70% of children have defined laterality (right and left handed), while 30% of children have a poorly defined laterality.

5.2. Measures

Two standardized tests have been used. These were Torrance Creative Thinking Test (1974) adapted by Jiménez, Artiles, Rodríguez, and García (2007) and neuropsychological test of the Institute of Neuropsychology and Education, adapted by Lobo, García-Castellón, Rodríguez, and Vallejo (2011). Literacy learning has been obtained by the average grade point for the language subject.

- Creativity. It was measured with the Torrance Creative Thinking Test (1974), adapted by: Jiménez et al. (2007). This test evaluates four components of creativity: originality, fluidity, flexibility and elaboration. Its purpose is to evaluate the level of creativity making drawings, valuing the components of originality, fluency, flexibility and elaboration. Fluency is measured by the number of responses the boy or girl gives, while flexibility is obtained by the variety of responses. Originality is measured by novel and unconventional responses, the elaboration being the amount of details that embellish and improve creative production (Jiménez et al., 2007). The age of application is 6 to 16 years. It is considered one of the most reliable tests by the scientific community.
- Laterality. It has been evaluated with the neuropsychological test of the Institute of Neuropsychology and Education, adapted by Lobo et al. (2011). The test measures laterality at

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the auditory, ocular, manual and foot level. The test is applicable from 4 years. Laterality was operationalized as difficulty ["0" right-handed, "1" left-handed, and "2" crossed laterality] and defined ["0"crossed laterality and "1" right-handed or left-handed]. Therefore, a high score in difficulty or defined laterality refers to "crossed laterality" and low scores refers to defined laterality (right or left handed).

- Literacy learning. It has been obtained by the average grade point for the language subject. The score goes from 1 to 10 where 1 is lower and 10 is higher.

6. Findings

6.1. Hypothesis Testing

Descriptive results and correlations of the variables considered in the study are presented.

Hypothesis 1 suggests that the relationship between cross laterality will be negative with learning but not with creativity. As shown in Table 01, the relationship between laterality "difficulty" and literacy learning is negative (r=-.32, $p<.05$). Furthermore, when the laterality variable was operationalized as defined, the results of the correlational analysis also indicated that the greater the degree of cross laterality, the worse the performance (r=-.38, $p<.01$). However, the correlation between laterality, operationalized as "difficulty" (r = -.04, *ns*) and operationalized as defined (r=-.8, *ns*) and creativity was not significant. Therefore, H1 is confirmed.

Table 01. Means, Standard Deviations and bivariate correlations

	M	SD	1	2	3	4	5
Creativity	6.71	1.33	1				
Literacy learning	.27	.45	.21	1			
Laterality "Difficulty"	1.63	.89	-.04	-.32*	1		
Laterality "Defined"	6.78	1.26	-.08	-.38**	.95**	1	
Sex	6.71	1.33	.12	.21	-.01	-.05	1

Note: *$p < .05$; ** $p < .01$. Men "0". Women "1". Laterality was operationalized as difficulty ["0" right-handed. "1" left-handed and "2" crossed laterality] and defined ["1"crossed laterality and "0" right-handed or left-handed]

Hypothesis 2 suggests that the relationship between crossed laterality will be negative with learning but not with creativity. The results show that there were differences between the learning of the defined lateralized (left-handed and right-handed) and the crossed. As can be seen in the table 02, the average in performance is higher in those of defined laterality (M = 7.40; DT = 1.22) than those of cross laterality (M = 6.13; DT = 0. 81) Student's t-test shows that this difference is significant (t = -3.69; gl = 41.17; $p<.001$). Thus, H2 is confirmed.

Table 02. Comparison of means and t test

Laterality	Mean Learning	SD	N	T	gl	p
Right and left handed	7.40	1.22	36			
Crossed Laterality	6.10	.81	24	-3.69*	41.17	.001

Note: * $p < .001$.

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Hypothesis 3a suggested that the relationship between creativity and learning would be different depending on the laterality and sex. As it can be observed in figure 01, the relationship between creativity and learning is positive for left-handed and right-handed people. Although this positive relationship is stronger in the case of boys. On the other hand, in the case of crossed laterality the relationship between creativity and learning is positive in girls although this relationship is week and the relationship is practically nil in boys. Nevertheless, these relationship are no significant. Therefore, H3a is not confirmed (Table 3).

Table 03. Results of the regression analysis for the learning

Variable	B	R2	ΔR^2
Creativity	0,48†		
Sex	2.56		
Laterality Defined	2.24		
Creativity * Sex	-0.32		
Creativity * Laterality Defined	-0,49		
Sex * Laterality	-2,61		
Creativity * Sex * Laterality Defined	0,40	.25*	.01

Note: B are non-standardized regression coefficients; †<.10; * p <.05; ** p <.01. Men "0". Women "1"

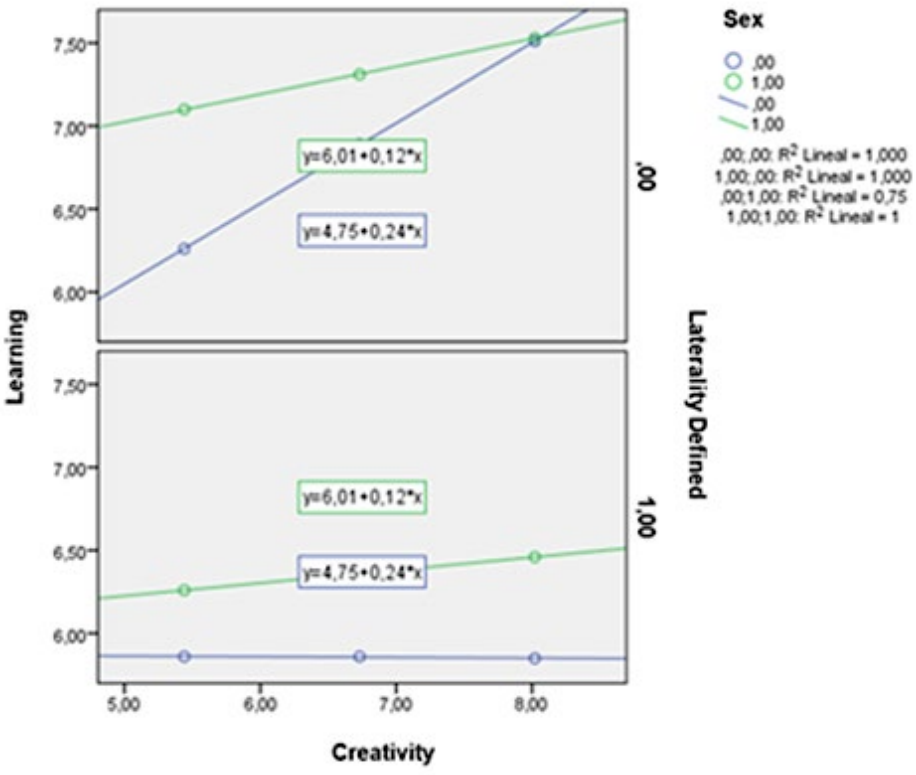

Figure 01. Results of the regression analysis for the learning

When the laterality variable was coded as difficulty, as can be seen in figure 02, the relationship between creativity and learning is positive in participants with laterality whose difficulty is low (right-handed) being this stronger positive relationship in the boys who in the girls. In left-handed or laterality study participants whose difficulty is moderate, the relationship between creativity and performance is

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positive although slightly weaker than in the right-handed, in this case it is also the boys who show a stronger relationship between creativity and performance than the girls. Finally, in the case of high difficulty or cross-laterality, the relationship between creativity and performance is positive although very weak in boys and practically nil in girls. However, although these results have been plotted to observe trends, the results cannot be taken into account because the interaction did not reach the level of significance required (B = 0.10, ns). Therefore, H3b is not confirmed (Table 4).

Table 04. Results of the regression analysis for the learning

Variable	B	R2	ΔR^2
Creativity	.64		
Sex	2.73		
Laterality “Difficulty”	.88		
Creativity * Sex	-0.32		
Creativity * Laterality “Difficulty”	-0,19		
Sex * Laterality “Difficulty”	-,72		
Creativity * Sex * Laterality “Difficulty”	.10	.22†	.01

Note: B are non-standardized regression coefficients; †<.10; * p <.05; ** p <.01. Men “0”. Women “1”

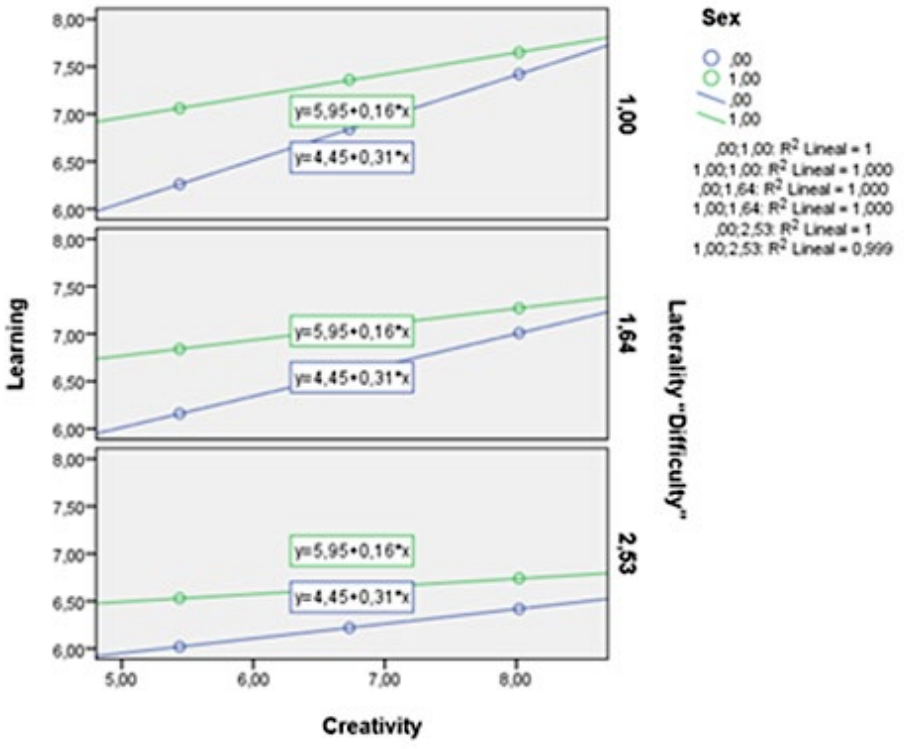

Figure 02. Results of the regression analysis for the learning

7. Conclusion

The main aim of the present study was to analyze the relationship between creativity and learning moderated by laterality and sex. Hypothesis 1 suggested that the relationship between cross laterality would negative with learning but not with creativity. The relationship between laterality "difficulty" and literacy learning is negative. Furthermore, when the laterality variable was operationalized as defined, the results

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of the correlational analysis also indicated that the greater the degree of cross laterality, the worse the performance. Therefore, H1 is confirmed. These results are in line with that obtained by Ferré, Catalán, Casaprima and Mombiela (2000), although this study considers that a poor lateral definition and immature psychomotor coordination is a risk factor for correct basic learning and adds that Visual mismatches can distort the results of laterality scanning. Ferré and Aribau (2014), are in the same line giving importance to a good lateral development for the correct learning, although they emphasize that it is important to have a correct maturation of the ocular processes. In this sense, Mayolas et al. (2010), analyze the relationship between crossed laterality and the problems with the acquisition of literacy learning, which will obviously have an impact on adequate learning and subsequent academic performance. They conducted a study with 170 students in which the best results in reading comprehension, mathematical reasoning and class attention were obtained by children with right-handed homogeneous laterality. However, the left-handed homogeneous and the crossed laterality students obtained the worst rating. However, in this study the left-handed lateralized, achieved the same result as the right-handed. Nevertheless, it should be taken into account, that in the sample of the Mayolas study, left-handed people were only 3% of the sample, and in the present study is 8.33%, so these results should be examined very carefully, since our sample is limited.

Hypothesis 2 suggested that the relationship between crossed laterality would be negative with learning but not with creativity. The results show that there were differences between the learning of the defined lateralized (left-handed and right-handed) and the crossed. The average in performance is higher in those of defined laterality than those of cross laterality. Therefore, H2 is confirmed. This result seems to be indicating that crossed laterality does not affect creativity and in some ways the negative relationship between cross-laterality and learning could be due more to the mode of evaluation and not so much to the learning itself. Furthermore, in our study there is no significant relationship between learning and creativity. This result is contrary to that carried out by Berenguer et al. (2016). For that reason, more studies are needed to analyze these relationships using other learning measures less dependent on the score or conventional evaluation.

Finally, hypothesis 3 suggested that the relationship between creativity and learning would be different depending on the laterality and sex. The results indicated that the relationship between creativity and learning is positive in the case of defined laterality participants (right or left handed) and stronger in girls than in boys. The results are not significant, but consistent with what it was obtained in the previous hypotheses, these results could be showing a trend in which creativity is important in learning. Although for this relationship to be captured in the case of cross-lateralized participants, it might be convenient to evaluate learning in a different way. Future studies should analyze the relationship between creativity and learning in crossed laterality cases, in larger samples and with other learning measures.

In conclusion, this study highlights the importance of creativity in learning. Moreover, these benefits could be captured to all children if the evaluation models are adapted to the specific cases such as laterality.

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