

Title : Qualitative differences in the way males and females use their imagination in creativity tasks.

Título: Diferencias cualitativas en la forma en que niños y niñas utilizan la imaginación en tareas creativas.

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Abstract:

En esta comunicación abordamos un tema a menudo controvertido: las diferencias en creatividad en función del sexo de los sujetos. Este estudio fue llevado a cabo con una muestra compuesta por 1277 sujetos, 754 varones y 523 mujeres, 697 niños de entre 9 y 12 años y 580 adolescentes de 13 a 18 años. Para la evaluación de la creatividad se utilizó la Prueba de Imaginación Creativa PIC-N (niños) y PIC-J (adolescentes). Nuestros resultados mostraron que tanto las niñas como las adolescentes obtuvieron mejores puntuaciones en la mayor parte de los índices de creatividad que los niños y chicos de estas edades. Estas diferencias entre sexos fueron mayores en los niños más jóvenes. Estos resultados parecen indicar que existen importantes diferencias cualitativas, más que cuantitativas, en la forma en que niños y niñas utilizan la imaginación en tareas creativas. Consideramos que estas diferencias cualitativas pueden deberse en parte a diferencias biológicas en los ritmos de maduración cerebral de niños y niñas, pero fundamentalmente son debidas a diferencias en los estilos de aprendizaje, las expectativas, y la motivación en el desarrollo de niños y niñas.

Palabras Clave: Creatividad, sexo, niños adolescentes, diferencias

Title :Qualitative differences in the way males and females use their imagination in Creativity tasks.

Abstract:

In this paper, we approach the relationship between two issues which stir up a wide controversy: gender and creativity. The investigation was conducted with a sample of 1277 subjects, 754 males and 523 females: 697 elementary students (9 to 12 years of age) and 580 adolescents (13 to 18 years of age). Our results indicate that in divergent thinking tests females of all ages obtained better results in almost all scores. Greater differences were found in younger children. These results seem to indicate that there are important qualitative, rather than quantitative, differences in the way boys and girls use their imagination in creativity tasks. We consider that these qualitative differences are probably due in part to genetic or biological factors, that might explain the difference between sexes in creative achievement in different domains. But mostly, we believe that these qualitative differences are also due to differences in learning styles, expectations, and motivations, in the development of boys and girls.

Key words: Creativity, sex differences, children, adolescents.

Introduction

In this paper, we approach the relationship between two issues which stir up a wide controversy: gender and creativity. We will try to find some answers to the following questions:

- Are there differences in the divergent thinking scores of men and women?
- Can we identify qualitative differences in the way males and females use their imagination in creativity tasks?
- Can these differences be attributed to global differences in the way males and females process information?
- Can gender differences be observed at every age level?

The answer to these questions is complex, and should be based on rigorous investigations and not on beliefs, judgments or prejudices. In this paper we will review the assessment of creativity in relation to sexual differences with the purpose of offering new data that can help resolve this controversy.

Review of sexual differences in creativity has not uncovered consistent differences in the types of thinking considered important for the development of creativity ((Baer, Runco & Pritzker 2008). Some of these studies have found some differences, but results across studies are not consistent.

Most studies have searched for the evidence of differences between sexes in divergent thinking tests. Results of these studies seem to be quite contradictory. Bauer, Runco and Pritzker (2008), in their revision of over 80 studies which have approached differences between sexes in divergent thinking, indicate that in more than a half of these studies, show no differences between boys and girls (i.e. Charyton, Basham y Elliot 2008; Kogan, 1974). Of the remaining studies left, two thirds of them revealed that women or girls over scored men or boys (i.e. Kershner & Ledger, 1985, Kuhn y Holling 2009; McLaughling, 2008), while one third favored men or boys over girls (i.e. Barrantes-Vidal, Caparrós, & Obiols, 1999.) Therefore they conclude that while there are research results pointing in various and often contradictory directions, the evidence does not clearly support differences between sexes in creativity based on test results, and that if these differences are found they must necessarily be small.

These small differences between girls and boys also seem to depend upon the age level of the subjects investigated. Mc Laughlin (2008) found that in preschool and elementary levels it is more frequent for girls to obtain better scores than boys. Among middle and high school students results are more controversial: in some studies girls score higher, and in others boys do, though there are a slight larger number of studies that favor girls. The same slight advantage favoring women is found in studies that compare adults (Kuhn & Holling, 2009).

Likewise, Matud, Rodriguez & Grande (2007) investigated differences in creativity between adult males and females employing the Figural and Verbal Torrance Test of Creative Thinking. Results of this study indicate that differences between sexes in creative thought were minimal and dependent upon educational level.

Some criticism has aroused towards these studies. In the first place, divergent thinking is only one aspect of creativity. Creativity is a much more complex construct. Secondly, many studies indicate that creativity is domain or task specific, therefore it is possible for girls to be better in certain domains, such as verbal or artistic ones, while boys may be better in the mechanical and scientific domains (Kuhn y Holling 2009) Finally, an important assumption that has rarely been tested, when comparing fluency scores across groups, is the measurement invariance of the divergent thinking tests used (Khun & Holling, 2009), and, in fact, whether the test is systematically biased against a specific subpopulation of participants and is equally valid for males and females. We believe that this measurement invariance must be proven before arriving at valid conclusions in the relationship between sex and creativity.

Some studies suggest that even though no consistent global differences in global scores of creativity have been found between males and females, some differences in specific aspects such as fluency, flexibility, originality or elaboration can exist.

McLaulglin (2008) found that girls scored significantly higher than boys in some aspects of divergent thinking such as flexibility and elaboration. Kerschner & Ledger (1985) found that girls (9-11 years), irrespective of their IQ level and style of thinking, scored significantly higher than boys in verbal and figural fluency. This advantage in girls verbal fluency has been confirmed by most studies conducted in western cultures (Kuhn & Holling, 2009, Maccoby and Jacklin, 1975). Fichnová (2002) also found some gender differences in some aspects of divergent thinking: girls had significantly higher scores in verbal fluency. Younger boys were more creative in movement and figural fluency. Young girls were verbally more creative and produced more ideas. Older girls elaborated more detailed solutions.

In summary, we can conclude that actual research has not uncovered consistent differences between sexes in creativity, though in those studies where differences have been found, female subjects usually score higher than males (Baer, 2008)

The Present Study

Our investigation group has devoted many years to the assessment of creativity. As a result, we believe that there are probably no large quantitative differences between sexes in creativity, but we hypothesize that significant qualitative differences can be found between males and females of all ages, and that these qualitative differences should be taken into account when designing and validating creativity tests.

We expect to prove that, since boys and girls probably process information differently, these differences will be reflected in their responses to creativity tests, therefore male and female responses will be qualitatively different

Furthermore, several studies have shown differences in the factors that motivate girls and boys. Therefore, we hypothesize that, when confronted with tasks that require the use of imagination, boys and girls react in a different way. Boys usually focus on action while girls focus on feelings and emotions. Girl's responses are much more

descriptive and include many more details (Sax, 2004). Therefore, we expect girls to give responses that refer to feelings, emotions, thoughts and desires as well as descriptions of characters and objects, while boys will give responses more related with action and fantasy or imagination.

Likewise, we expect girls and women to obtain higher scores in fluency and elaboration. On the other hand, since girls are usually less motivated to take risks, and are therefore less daring, we expect them to obtain lower scores in originality, and special details.

We also sustain that creativity is probably domain specific therefore we expect that girls to be better in certain domains, such as verbal creativity, while boys may be better in other domains.

Method:

Participants

A total of 1277 subjects participated in this study (754 males and 523 females). The total sample was composed of 697 elementary students (8 to 12 years of age) and 580 adolescents (13 to 18 years of age).

Measures

For the assessment of creativity, the PIC (“Prueba de Imaginación Creativa”), a test specifically designed for Spanish population, was employed. This test has shown good psychometric properties (Artola & Barraca, 2004) and is widely used for the assessment of creativity in the Spanish population.

The PIC evaluates creativity by examining how subjects use their imagination in four different tasks, which we call “games”, in order to avoid the feeling of being evaluated. The first three tasks or games assess verbal creativity; the fourth graphical or figural creativity.

In the first task subjects must look at a drawing and indicate all the possible things that might be happening in the scene presented. Subject’s responses are classified, depending on their nature, in different categories. The second task is similar to Guilford’s possible uses of objects. The third task evaluates fantasy and imagination by presenting the subject with an unusual or imaginary situation and he has to judge what might happen in this situation. Finally in the fourth task the subject has to make an original drawing from a few lines given. Measures of fluency, flexibility, originality, elaboration, and specific details can be obtained.

The PIC has two different versions, one version for each age group. The PIC-N (Artola, Ancillo, Mosteiro & Barraca, 2004) was employed for evaluating elementary students (8-12 years of age). The PIC-J (Artola, Barraca, Mosteiro, Martín, Ancillo & Poveda, 2008) was used for assessing secondary and high school students.

Verbal and graphic creativity scores were obtained for elementary, secondary and high school students, by considering subject's responses to the four tasks. Likewise, fluency, flexibility, originality, elaboration, title and special details scores were calculated.

Finally, a qualitative examination of the subject's responses was conducted. For this analysis, subject's responses to the first task of the PIC were qualitatively analyzed. In this task the subjects must look at a scene and indicate all possible things that might be happening. The subject's responses to this scene were classified according to the following categories:

1. Responses that refer to some type of **action**: *The boy is opening the chest, the monkey is going to attack the boy, the girl is pushing the boy into the water, the man is playing the guitar, etc.*
2. Responses related with the **description** of the scene, the characters, the situation...: *The boy is poorly dressed, the lake is very dirty, the houses are very tall, it's hot, etc..*
3. Responses which refer to **emotions**, moods, feelings, desires... *The boy is very angry, the girl loves the boy very much, the man playing the guitar is feeling very sad, the music he is playing is very romantic, etc.*
4. Responses which refer to **imagination**: references to characters, animals or objects that don't appear explicitly in the scene as well as references related to **mystery, fantasy...** *A big monster is going to jump out of the lake, the boy is trying to look for a corpse in the water, "a big rat is going to come out, etc..*
5. **Extension**: responses that include references to past or future events related with the scene.

Finally an additional analysis was conducted by examining separately the subjects scores in each of the four games included in the PIC; since we believe that the type of responses required in each task are probably quite different. The first game requires mainly "description" (*"Describe all things that might be happening in this scene"*); the second game requires activity and "action" (*"Tell me whatever the things you could make with a rubber tube"*); the third game requires fantasy and imagination (*"Tell me what you think could happen if the floor was elastic"*) while the fourth task implies mainly original perception (*"complete an original drawing"*).

Results

Global creativity scores.

To test for global differences between sexes in creativity, we searched for significant differences in the total score of creativity, verbal creativity and graphic or figural creativity by employing Student's *t* statistic.

In the case of elementary students (PIC-N), significant differences were found in global creativity ($t= 6,70$, $p<0,001$) as well as in verbal creativity ($t= 6,36$, $p<0,001$) in both measures girls outscored boys. No significant differences were found in graphic creativity ($t= 0,40$, $p>0,05$) though boys obtained slightly better scores than girls in this type of creativity.

Table 1:

Mean, standard deviation, standard error and significance for verbal creativity, graphic creativity and global creativity in elementary students.						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Verbal Creativity	Boys	498	64,84	41,57	1,86	-6,70***
	Girls	199	88,11	41,00	2,91	
Graphic Creativity	Boys	499	15,23	8,68	0,39	0,46
	Girls	199	14,96	6,22	0,44	
Total Creativity	Boys	498	80,09	43,44	1,95	-6,36***
	Girls	199	103,07	42,12	2,99	

P<0,05*
P<0,01**
P<0,001***

Likewise, when we examined global creativity scores in secondary and high school students (PIC-J), significant differences between males and females were found in global creativity ($t=2,52$, $p<0,05$), and verbal creativity ($t= 2,49$, $p<0,05$), with females obtaining a significant mean advantage over males. Again no significant differences were found in graphic creativity ($t= 0,91$, $p>0,05$).

Table 2:

Mean, standard deviation, standard error and significance for verbal creativity, graphic creativity and global creativity in secondary and high school students.						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Verbal Creativity	Males	256	92,27	37,73	2,36	-2,48*
	Females	324	99,91	35,99	2,00	
Graphic Creativity	Males	256	9,68	4,55	0,29	-0,91
	Females	323	10,02	4,36	0,24	
Global Creativity	Males	256	101,94	39,07	2,44	-2,52*
	Females	323	109,95	37,01	2,06	

P<0,05*
P<0,01**
P<0,001***

Divergent thinking factors.

In elementary students (ages 9 to 12) we analyzed differences between boys and girls in the different factors considered when evaluating divergent thinking. We found significant differences in almost all factors: fluency ($t= 6,59$, $p<0,001$), flexibility ($t=9,08$, $p<0,001$), and originality ($t=5,25$, $p<0,001$), indicating that girls obtained significantly higher scores than boys in all of these factors. Boys obtained significantly higher scores in special details ($t= 2,58$, $p<0,05$).

Table 3:

Mean, standard deviation, standard error and significance for fluency, flexibility, originality and special details in elementary students						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Fluency	Boys	499	35,00	21,92	0,98	-6,59***
	Girls	199	47,08	21,63	1,53	
Flexibility	Boys	499	16,25	7,32	0,33	-9,08***
	Girls	199	21,73	6,90	0,49	
Originality	Boys	499	19,99	15,48	0,69	-5,24***
	Girls	199	26,93	16,56	1,17	
Special Details	Boys	499	0,37	0,83	0,04	2,57**
	Girls	199	0,23	0,56	0,04	

P<0,05*
P<0,01**
P<0,001***

Likewise, significant differences were found between secondary and high school boys and girls in some factors of divergent thinking: fluency ($t= 2,73$, $p<0,05$) and flexibility ($t=2,80$, $p<0,05$). No significant differences were found in originality ($t= 1,68$, $p>0,05$) and special details ($t=1,65$, $p>0,05$).

Table 4:

Mean, standard deviation, standard error and significance for fluency, flexibility, originality and special details in secondary and high school students.						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Fluency	Males	256	45,71	19,90	1,24	-2,73**
	Females	324	50,15	19,06	1,06	
Flexibility	Males	256	28,55	8,28	0,52	-2,80**
	Females	324	30,41	7,68	0,43	
Originality	Males	256	22,68	12,45	0,78	-1,67
	Females	323	24,38	11,84	0,66	
Special Details	Males	256	0,58	1,08	0,07	1,65
	Females	324	0,45	0,83	0,05	

P<0,05*
P<0,01**
P<0,001***

Scores in different games or tasks

We also conducted an additional analysis considering the scores obtained separately in each of the four tasks involved in the PIC.

In elementary students, the results obtained in the PIC-N were as follows: girls scored significantly higher than boys in all factors of the first game, which required subjects to describe everything that could be happening in a scene: both in fluency ($t=4,03$, $p<0,001$) and flexibility ($t= 6,68$, $p<0,001$). In the second task or game, where the subjects had to think about possible uses of objects, the results obtained were similar, since girls over scored boys in all factors considered: fluency ($t=7,04$, $p<0.001$), flexibility ($t=7,19$, $p<0,001$) and originality ($t=3,81$, $p<0,001$). The same results were found in the third task, which required the use of fantasy or imagination. Girls obtained significantly better results in fluency ($t=5'16$, $p<0,001$), flexibility ($t=7,73$, $p<0,001$) and originality ($t=04,8$, $p<0,001$).

In the fourth task, which assessed graphic creativity, results were quite different. Boys obtained significantly better results in elaboration ($t= 2,03$, $p<0,05$) and special details ($t=2,58$, $p<0,01$), while girls obtained better results in shadows and color ($t=4,91$, $p<0,001$). No significant differences were found in originality in this task ($t=0,014$, $p>0,05$).

Table 5:

Mean , standard deviation, standard error and significance for the different tasks or games of the PIC-N						
	Sex	N	Mean	SD	SE of M	t
Game 1 fluency	Boys	499	15,79	9,55	0,43	-4,03***
	Girls	199	18,96	8,91	0,63	
Game 1 flexibility	Boys	499	6,16	2,21	0,10	-6,68***
	Girls	199	7,41	2,24	0,16	
Game 2 fluency	Boys	499	11,44	9,53	0,43	-7,04***
	Girls	199	17,13	9,88	0,70	
Game 2 flexibility	Boys	499	6,54	4,42	0,20	-7,18***
	Girls	199	9,13	3,97	0,28	
Game 2 Originality	Boys	499	10,48	11,30	0,51	-3,18***
	Girls	199	14,02	10,38	0,74	
Game 3 Fluency	Boys	499	7,77	7,21	0,32	-5,16***
	Girls	199	10,99	7,99	0,57	
Game 3 Flexibility	Boys	499	3,54	2,45	0,11	-7,73***
	Girls	199	5,20	2,81	0,20	
Game 3 Originality	Boys	499	3,60	5,54	0,25	-4,82***
	Girls	199	7,02	9,38	0,66	
Game 4 elaboration	Boys	499	4,76	8,16	0,37	2,03*
	Girls	199	3,69	5,30	0,38	
Game 4 Color and shadows	Boys	499	1,79	2,21	0,10	-4,90**
	Girls	199	2,60	1,87	0,13	
Game 4 Special Details	Boys	499	0,37	0,83	0,04	2,57**
	Girls	199	0,23	0,56	0,04	

P<0,05*

P<0,01**

P<0,001***

In secondary and high school students (12 to 18 years), differences between boys and girls were not so obvious. Girls obtained significantly better results than boys only in the first game, both in fluency ($t=2,93$, $p<0,005$) and flexibility ($t=2,94$, $p<0,005$), and the same happened in the second task likewise in fluency ($t=2,86$, $p<0,005$) and flexibility ($t= 3,38$, $p<0,001$). However no significant differences were found in originality between girls and boys in the second task ($t=1,78$, $p>0,05$) nor in any of the factors of the third task: fluency ($t=1,18$, $p>0,05$), flexibility ($t=0,15$, $p>0,05$); and originality ($t=0,69$, $p>0,05$). In the graphic task no significant differences were found between sexes in any of the factors considered: originality ($t=0,16$, $p>0,05$) ; elaboration ($t= 0,35$, $p>0,05$) ; or special details ($t= 1,65$, $p>0,05$). Slight differences were found favoring girls in Title ($t= 2,18$, $p<0,05$).

Table 6:

Mean, standard deviation, standard error and significance for the different tasks or games of the PIC-J						
	Sex	N	Mean	SD	SE of M	t
G1 Fluency	Males	256	15,78	7,84	0,49	-2,93**
	Females	324	17,61	7,17	0,40	
G1 Flexibility	Males	256	10,53	3,21	0,20	-2,94**
	Females	324	11,28	2,95	0,16	
G2 Fluency	Males	256	15,31	8,01	0,50	-2,85**
	Females	324	17,28	8,41	0,47	
G2 Flexibility	Males	256	9,31	4,03	0,25	-3,38***
	Females	324	10,47	4,14	0,23	
G4 Title	Males	256	2,63	1,93	0,12	-2,17*
	Females	324	2,99	1,99	0,11	

P<0,05*
P<0,01**
P<0,001***

Categories of responses.

We also conducted a new analysis aimed at finding qualitative differences in the type of categories chosen by males and females in the first task of the PIC of both age groups.

In elementary students, girls obtained significantly higher means than boys in those categories that refer to actions ($t=4,85$, $p<0,001$), descriptions ($t=2,97$, $p<0,005$) and emotions ($t=2,84$, $p<0,05$). Boys obtained significantly higher scores in “extension” ($t=2,61$, $p<0,05$). No significant sex differences emerged in those categories referring to fantasy.

Table 7:

Mean, standard deviation, standard error and significance for categories of action, description, fantasy, emotions, and extension in elementary students. PIC-N						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Action	Boys	499	2,07	2,42	0,11	-4,85***
	Girls	199	3,37	3,46	0,24	
Description	Boys	499	3,20	2,89	0,13	-2,97**
	Girls	198	3,92	2,88	0,20	
Fantasy	Boys	498	1,28	1,18	0,05	-0,94
	Girls	199	1,43	2,15	0,15	
Emotions	Boys	498	0,48	0,90	0,04	-2,84**
	Girls	199	0,69	0,85	0,06	
Extension	Boys	498	0,70	0,90	0,04	2,60*
	Girls	198	0,49	1,05	0,07	

P<0,05*
P<0,01**
P<0,001***

When considering secondary and high school students, we obtained somewhat different results. Significant differences were found in categories referring to fantasy ($t= 2,50$, $p<0,05$), emotions ($t=2,05$, $p<0,05$) and extension ($t=3,55$, $p<0,001$). In these three categories, girls obtained higher scores than boys. No significant differences were found in action ($t= 0,42$, $p>0,05$) and description ($t=0,98$, $p=>0,05$).

Table 8:

Mean, standard deviation, standard error and significance for categories of action, description, fantasy, emotions, and extension in secondary and high school students. PIC-J.						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Action	Males	255	9,49	6,07	0,38	0,42
	Females	322	9,29	5,19	0,29	
Description	Males	255	7,34	5,19	0,33	-0,98
	Females	321	7,74	4,60	0,26	
Fantasy	Males	254	5,06	4,24	0,27	-2,49*
	Females	319	5,99	4,62	0,26	
Emotions	Males	255	2,44	2,71	0,17	-2,05*
	Females	322	2,89	2,63	0,15	
Extension	Males	254	1,17	1,52	0,10	-3,54***
	Females	321	1,65	1,78	0,10	

P<0,05*
P<0,01**
P<0,001***

Frequency of categories.

In order to complete this qualitative analysis, we tested for possible differences in each of the individual categories used to classify subject's responses to task or game one.

Significant differences between elementary girls and boys emerged in categories 1, 2, 4, 5, 8, 10, 11 and 12, that were significantly more frequent in girls, while category 15 was significantly more frequent in boys.

Table 9:

Mean , standard deviation, standard error and significance for each category of game 1 in elementary students: PIC-N.						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
CAT1	Boys	499	0,96	1,01	0,05	
	Girls	199	1,25	1,23	0,09	-2,91**
CAT2	Boys	499	0,77	1,11	0,05	
	Girls	199	1,16	1,65	0,12	-3,07**
CAT4	Boys	499	0,21	0,55	0,02	
	Girls	199	0,54	1,07	0,08	-4,14***
CAT5	Boys	499	0,24	0,46	0,02	
	Girls	199	0,44	1,27	0,09	-2,16*
CAT8	Boys	499	0,34	0,58	0,03	
	Girls	199	0,47	0,81	0,06	-2,06*
CAT10	Boys	499	0,21	0,59	0,03	
	Girls	199	0,36	0,67	0,05	-2,64**
CAT11	Boys	499	0,25	0,55	0,02	
	Girls	198	0,44	0,67	0,05	-3,55***
CAT12	Boys	499	0,28	0,77	0,03	
	Girls	199	0,96	1,82	0,13	-5,11***
CAT15	Boys	498	0,70	0,90	0,04	
	Girls	198	0,49	1,05	0,07	2,60*

P<0,05*

P<0,01**

P<0,001***

In secondary and high school students, girls differed significantly from boys in the frequency with which they used categories 9, 10, 11, 12, 17 and 19. All of these categories were significantly more frequent in girls.

Table 10:

Mean , standard deviation, standard error and significance for each category of game 1 in secondary and high school students: PIC-J.						
	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
CAT9	Males	255	0,66	1,12	0,07	-2,13*
	Females	321	0,87	1,24	0,07	
CAT10	Males	255	0,05	0,30	0,02	-2,74**
	Females	322	0,16	0,69	0,04	
CAT11	Males	254	1,03	1,45	0,09	-2,66**
	Females	321	1,36	1,57	0,09	
CAT12	Males	255	0,32	0,71	0,04	-4,95**
	Females	322	0,78	1,47	0,08	
CAT17	Males	255	0,82	1,15	0,07	-2,00*
	Females	320	1,05	1,52	0,09	
CAT19	Males	255	1,54	1,72	0,11	-2,56
	Females	322	1,94	2,05	0,11	

P<0,05*
P<0,01**
P<0,001***

Discussion

The results obtained do not agree entirely with our first hypothesis, since we expected no large quantitative differences in creativity between sexes. Our results indicate that both in childhood and adolescence, girls outscore boys in global and verbal creativity. No significant differences were found in graphic creativity. These results are in accordance with those found by several investigators (Kershner & Ledger, 1985, Kuhn & Holling, 2009, McLaughlin, 2008, Sánchez, 2009). There are many investigations that point to differences in mental abilities between boys and girls (Gil-Verona et al, 2003, MacCoby & Jacklin, 1974). Most studies indicate that women outstand in language, perceptual speed and verbal fluency. Since we believe that creativity is probably domain specific, we argue that, if divergent thinking tests evaluate creativity only through verbal tasks, both boys and men will probably be underestimated.

We did expect to find differences between males and females in the different factors usually evaluated by divergent thinking tests. This hypothesis was confirmed since girls of all levels, elementary, secondary and high school, obtained better scores than boys in fluency and flexibility. Also younger girls obtained better results than boys of this age in originality. Likewise, these results were confirmed in elementary students independently of the type of response required (description, action or fantasy), as long as it was a verbal task. In graphical or figural tasks differences between elementary boys and girls reversed: boys obtained better results in the graphic task, especially in elaboration and special details. These results concur with those obtained by several investigators (Fichnova, 2002, Kerschner & Ledger, 1985, Kuhn and Holling, 2009, McLaughlin, 2008, and Xiaoaia, 1999), who also found that girls and boys differed significantly in some aspects of divergent thinking particularly in fluency of responses.

In secondary and high school students differences between boys and girls were less obvious. Girls still overscored boys in fluency and flexibility for the first two games (which implied description and action) but no differences were observed either in the third game (which required fantasy) or in the graphic task for boys. Therefore it

seems that, as Catalina (1999) said, sex differences in divergent thinking are more profound in younger children and as they approach adolescence these differences decrease.

Several investigators (Hanlon, Thatcher & Cline, 1999, Sax, 2005, 2007) sustain that the various brain regions of boys and girls possibly have a different sequence of development, and that the areas of the brain involved in language, spatial memory and social development develop in a different order, time and rate in boys and girls. These differences in development might be responsible for the differences found in divergent thinking.

Likewise, other studies point out that boys and girls process information in a different way (Razumnikova & Bryzgalov, 2006). These differences in perception and processing might also account for the differences observed in our study.

The analysis of the categories of responses used the most by males and females in the first game, in order to examine qualitative differences in the way they use their imagination in creativity tasks, indicates that male and female style of responses differ depending on the age of the population studied. In children girls stand out in those categories that refer to actions, descriptions and emotions, whereas boys do so in extension. In adolescents, girls outstand in fantasy, emotions and extension.

These results, though slightly confusing, probably indicate that both during childhood and adolescence, boys and girls have different interests and motivations, as several of the investigators reviewed have stated (Matud et al., 2006, Razumnikova, 2006, Rhoads, 2004), and therefore their responses differ qualitatively in their content. As they grow up, differences in the categories chosen diminish.

A more detailed analysis indicates that, in childhood, girls differed from boys in that they used more the following categories: 1 and 2 (actions conducted by the main character), 4 (references to time or the moment when the scene takes place) 5, (description of physical characteristics of the scene) 8, (identity of the main character), 10 (psychological and moral characteristics of the character) 11, (references to things that happened in the past to the character), 12 (references to occupation or job of the main character). Boys used significantly more category 15 (references to imaginary objects, animals or characters that don't appear in the scene).

Secondary and high school girls differed from boys in that they used significantly more the following categories: 9 (identity of the characters), 10 (background of the characters), 11, (events that happened before the scene), 12 (relationships between characters), 17 (references to imaginary people that don't appear on the scene) and 19 (references to objects that don't appear in the scene).

As a general conclusion of the investigation conducted, we have to state that there are quite many differences in the way males and females use their imagination in creativity tasks. These differences indicate that most divergent thinking tests, because they favor fluidity, flexibility and elaboration, instead of novelty, activity or originality might be biased towards girls or might not be equally valid for males and females. Likewise, most creativity tests stress verbal tasks and therefore might not be

adequate for certain populations. Measurement invariance must be proven in order to insure that a specific subpopulation is underestimated. Likewise, we must question if the same identification procedures can be used when identifying high ability and creative students or not.

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