

BOYS AND GIRLS CREATIVITY: QUALITATIVE DIFFERENCES IN DIVERGENT THINKING

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ABSTRACT:

In this paper, we explore if differences can be found between males and females in the way they use their imagination when solving new or divergent thinking problems. The investigation was conducted with a sample of 1377 subjects, 790 males and 587 females: 697 elementary students, 579 secondary and high school students and 100 adults. Our results indicate that in divergent thinking tests girls and female adolescents obtained better results in almost all scores, particularly when divergent thinking was assessed through verbal tasks. Differences were greater in younger children, while in adults no significant gender differences were found between males and females. From the results obtained we can conclude that boys and girls solve divergent thinking problems in a different way. These qualitative differences should be taken into account when promoting creativity in schools and imply that we must be careful when using the same identification procedures for identifying high ability boys and girls.

INTRODUCTION

In this paper we investigate sex differences in the use of imagination and in the solving of divergent thinking problems, and their importance for the development of creativity in schools and the identification of high ability students. 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 gender differences be observed at every age level?
- Are these differences important enough in order to be taken into account when identifying gifted children?
- Are these differences important enough to be considered when promoting creativity through education?

DEVELOPMENT

As the result of more than ten years of experience, devoted to the study of creativity, we believe that probably there are no large quantitative differences between sexes in creativity, but we hypothesize that significant qualitative differences can be found between males and females, and that these qualitative differences should be considered when promoting creativity in schools and when using creativity tests to identify high ability students for special enrichment programs.

Several studies have found differences in the factor's that motivate girls and boys. Therefore, we hypothesize that, when confronted to 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 and also their responses are much more descriptive and include many more details. As Leonard Sax says (Sax 2004) *'For boys or men it's just not*

cool to describe". Therefore, we expect girls to give more responses that refer to feelings, emotions, thoughts and desires as well as descriptions of characters and objects, while boys will give more responses related with action and fantasy or imagination.

Likewise, we expect that girls and boys will be different in some of the variables implicated in divergent thinking: fluency, flexibility, originality, elaboration and details.

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

PARTICIPANTS

A total of 1377 subjects participated in this study (790 males and 587 females). The total sample was composed of 697 elementary students, 8 to 12 years of age, (498 boys and 199 girls) .579 secondary and high school students, 12-18 years of age, (256 boys and 323 girls). Finally a small sample of 100 university students and adults also participated, 36 men and 64 women.

MEASURES

For the assessment of creativity, the PIC ("Prueba de Imaginación Creativa"), a test specifically designed for Spanish population, was employed. The PIC evaluates creativity by examining how subjects use their imagination in four different tasks, 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 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 fantastic situation and the subject has to judge what could happen in this situation. Finally in the fourth task the subject has to make an original drawing given a few lines to complete. Measures of fluency, flexibility, originality, elaboration, and specific details can be obtained.

The PIC has three 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. Finally the PIC-A (Artola, Barraca, Mosteiro, Ancillo, Sánchez & Poveda, 2012) was used for evaluating university students and adults.

Verbal and graphical creativity scores were obtained for elementary, secondary and high school students, and university students and adults, 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 subject's responses was conducted.

For this last analysis, subject's responses to the first task of the PIC were qualitatively analyzed. In this task subjects must look at a scene and indicate all possible things that might be happening. 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 with **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.

RESULTS

Global creativity scores.

When the data of the whole sample, children, adolescents and adults, were considered, significant gender differences were found in total creativity scores, indicating that females obtained better scores in creativity than men. Likewise, females obtained significant better means in verbal creativity while men obtained significant better means in graphic creativity (see table 1).

These global results can be clarified by considering separately the results obtained in each group of age.

In the case of elementary students (PIC-N), and also in high school students (PIC-J), significant differences were found in global creativity as well as in verbal creativity, in both measures girls outscored boys. No significant differences were found in graphic creativity. In adult population, results were quite different. Differences between men and women didn't result significant (see tables, 2,3,4).

Divergent thinking factors.

In second place, we searched for differences between sexes in the different factors considered when evaluating divergent thinking. When the total sample was considered, females generally over scored men in most divergent thinking factors: fluency, flexibility and originality (see table 5).

If we examine the results obtained by each age group, results are as follows:

In elementary students (ages 9 to 12) significant differences were found in almost all factors: fluency, flexibility and originality, indicating that girls obtained significantly higher scores than boys in all these factors. But in special details, boys obtained significant better scores than girls. Likewise, significant differences were found between secondary and high school boys and girls in some factors of divergent thinking: such as fluency and flexibility. No significant differences were found in originality and special details. In adults, no significant gender differences were found in any of the divergent thinking factors considered.(see tables 6,7,8).

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 task which requires subject's to describe everything that could be happening in a scene: both fluency and flexibility. In the second task or game, which requires that subjects think about possible uses of objects, results obtained were similar, since girls over scored boys in all factors considered: fluency, flexibility and originality. The same results were found in the third task, which requires the use of fantasy or imagination. Girls obtained significantly better results in fluency, flexibility and originality.

In the fourth task, which assesses graphic creativity, results were quite different. Boys obtained significantly better results in elaboration and special details, while girls obtained better results in the use of shadows and color. No significant differences were found in originality in this task.

In secondary and high school students, (12 to 18 years) differences between boys and girls were not so obvious. Girls ob-

tained significantly better results than boys only in fluency and flexibility of the first two games or tasks. But no significant differences were found between girls and boys in originality of the second task, nor in any of the factors of the third task. In the graphical task no significant differences were found between sexes in none of the factors considered. Slight differences were found, favoring girls in Title (assigning a creative title to their drawings).

In university students and adults, results obtained showed no significant differences between males and females in none of the games included in the PIC-A (see tables, 9,10, 11).

Categories of responses.

Also we conducted a new analysis aimed towards the possibility of finding qualitative differences in the type of categories chosen by males and females in the first task of the PIC of all groups.

In elementary students, girls obtained significantly higher means than boys in those categories that refer to actions, descriptions and emotions. Boys obtained significantly higher scores in "extension". No significant sex differences emerged in those categories referring to fantasy.

When considering secondary and high school students, we obtained somewhat different results. Significant differences were found in categories referring to fantasy, emotions, and extension. In these three categories, girls obtained higher scores than boys. No significant differences were found in action and description.

In the sample of university students and adults, no significant differences were found in any of the groups of categories considered (see tables 12,13,14).

CONCLUSIONS

The results obtained don't agree totally with our first hypothesis, since we expected no large inter sex quantitative differences in creativity. Our results indicate that in the total sample studied, females outscore males in global and verbal creativity. Differences decrease and become non-significant in adult population. In graphic creativity males obtain significantly better results than females.

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, when the total sample was considered, females obtained better scores than males in fluency, flexibility, and in some groups, also in originality. These differences were more intense in younger students, and disappeared in university students and adults.

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 girl reversed: boys obtained better results in the graphic task, especially in elaboration and special details.

In secondary and high school students differences between boys and girls were less notorious. Girls still over scored boys in fluency and flexibility of the first two games (which imply description and action) but no differences were observed neither in the third game (which required fantasy) nor in the graphic task for boys. Therefore it seems that sex differences in divergent thinking are more intense in younger children and as they approach adolescence these differences decrease and finally disappear in adulthood.

Several previous investigations (Hanlon, Tatcher & Cline, 1999, Sax, 2005, 2007) sustain that possibly boys and girls have a different sequence of development of the various brain regions, and that the areas of 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 of the differences found in divergent thinking of elementary and secondary students.

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 more frequently by males and females in the first game, indicates that males and females style of responses differ depending of the age of the population studied. In children girls stand out in those categories that refer to actions, descriptions and emotions. Boys stand out in extension. In adolescents, girls outstand in fantasy, emotions and extension. In adults no differences were found in the type of responses produced.

These results, though slightly confusing, probably indicate that both in children and in adolescents, boys and girls have different interests and motivations, as several investigators reviewed affirm (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.

As a general conclusion of the investigation conducted, we have to affirm 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, since they favor fluidity, flexibility or 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 boys. Likewise we must question if the same identification procedures can be used for girls and boys when identifying high ability and creative students.

Also our results demonstrate that, since creativity is probably domain specific, if divergent thinking tests evalu-

ate creativity only through verbal tasks boys and men will probably be underestimated. Likewise, if creativity is promoted in schools only through verbal tasks such as oral expositions or writing, boys will probably not be interested in showing creativity.

Likewise boys should be encouraged to give more responses and explore different perspectives when solving problems, since they tend to stick to their first answer and show less fluency and flexibility when confronted with new problems and situations. Girls should be encouraged to take more risks and dare to give responses which might be considered out of place by others.

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ANNEX

Table 1

Mean, standard deviation, standard error and significance for verbal creativity, graphic creativity and global creativity in the complete sample.

	Sex	<i>N</i>	<i>Mean</i>	<i>SD</i>	<i>SE of M</i>	<i>t</i>
Verbal Creativity	Males	790	75,62	42,70	1,51	-9,60***
	Females	587	96,44	37,48	1,54	
Graphic Creativity	Males	791	13,27	7,88	0,28	3,98***
	Females	586	11,83	5,54	0,22	
Total Creativity	Males	790	88,91	43,54	1,54	-8,77***
	Females	586	108,34	38,27	1,58	

P<0,05*

P<0,01**

P<0,001***

Table 2

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	Males	498	64,84	41,57	1,86	-6,70***
	Females	199	88,11	41,00	2,91	
Graphic Creativity	Males	499	15,23	8,68	0,39	0,46
	Females	199	14,96	6,22	0,44	
Total Creativity	Males	498	80,09	43,44	1,95	-6,36***
	Females	199	103,07	42,12	2,99	

P<0,05*

P<0,01**

P<0,001***

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Table 3

Mean, standard deviation, standard error and significance for verbal creativity, graphic creativity and global creativity in secondary and high school students.

	Sex	N	Mean	SD	SE of M	t
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***

Table 4

Mean, standard deviation, standard error and significance for verbal creativity, graphic creativity and global creativity in adults.

	Sex	N	Mean	SD	SE of M	t
Verbal Creativity	Males	36	106,52	39,43	6,57	0,22
	Females	64	104,84	28,16	3,52	
Graphic Creativity	Males	36	11,80	5,44	0,90	0,51
	Females	64	11,29	4,28	0,53	
Total Creativity	Males	36	118,33	39,77	6,62	0,22
	Females	64	116,62	29,24	3,65	

P<0,05*

P<0,01**

P<0,001***

Table 5

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>
Fluency	Males	791	38,82	21,64	0,76	-8,77***
	Females	587	48,43	19,50	0,80	
Flexibility	Males	791	20,85	9,77	0,34	-8,62***
	Females	587	27,45	8,40	0,34	
Originality	Males	791	21,16	14,44	0,51	-13,43***
	Females	586	25,16	13,43	0,55	

P<0,05*

P<0,01**

P<0,001***

Table 6

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***

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Table 7

Mean, standard deviation, standard error and significance for fluency, flexibility, originality and special details in secondary and high school students.

	Sex	N	Mean	SD	SE of M	t
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***

Table 8

Média, desvio padrão, erro padrão e significado em termos de fluência, flexibilidade, originalidade e pormenores especiais nos adultos

	Sex	N	Mean	SD	SE of M	t
Fluência	Males	36	43,00	16,57	2,76	-0,29
	Females	64	43,95	12,73	1,59	
Flexibilidade	Males	36	30,02	8,41	1,40	-0,13
	Females	64	30,25	7,00	0,87	
Originalidade	Males	36	26,77	9,96	1,66	1,61
	Females	64	23,62	9,01	1,12	
Pormenores especiais	Males	36	0,69	1,11	0,18	1,20
	Females	64	0,46	0,75	0,09	

P<0,05*

P<0,01**

P<0,001***

Table 9

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***

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Table 10

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***

Table 11

Mean, standard deviation, standard error and significance for the different tasks or games of the PIC-A						
	Sex	N	Mean	SD	SE of M	t
Game 1 Total	Males	36	40,86	18,26	3,04	0,14
	Females	64	40,34	13,65	1,70	
Game 2 Total	Males	36	37,22	18,24	3,04	1,11
	Females	64	33,35	13,37	1,67	
Game 3 Total	Males	36	28,41	13,15	2,19	-0,91
	Females	64	30,73	11,52	1,44	
Game 4 Total	Males	36	11,86	5,36	0,89	0,56
	Females	64	11,31	4,24	0,53	

Table 12

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***

Table 13

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***

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Table 14

Mean, standard deviation, standard error and significance for categories of action, description, fantasy, emotions, in adults. PIC-A

	Sex	N	Mean	SD	SE of M	t
Action	Males	29	9,17	7,92	1,47	0,98
	Females	60	7,62	4,48	0,58	
Description	Males	29	8,00	3,31	0,61	-0,98
	Females	60	8,83	3,92	0,51	
Fantasy	Males	29	3,31	3,22	0,60	0,19
	Females	60	3,18	2,71	0,35	
Emotions	Males	29	3,83	4,38	0,81	2,01*
	Females	60	2,42	2,26	0,29	
Extension	Males	29	1,38	2,29	0,43	1,334
	Females	60	0,88	1,22	0,16	

P<0,05*

P<0,01**

P<0,001***