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Divergent Thinking In Children With Down Syndrome

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Abstract

The present study was focused on comparing the factors of divergent thinking between children with Down syndrome and children with typical development. The sample was composed by 63 children, divided in 30 typically developed and 33 disabled children. We used the Test of Divergent Thinking (Williams, 1994) to analyze creative performances and Logical Operations Tasks (Vianello & Marin, 1991) to measure the cognitive level of children. We matched the two groups in relation to cognitive levels. Results showed that, at the pre-operational and intermediate cognitive level, children with Down syndrome scored equally on fluency, flexibility, originality, and elaboration than children with typical development. At the concrete operational cognitive level, significant differences between the two groups emerged only for creative verbal production: children with Down syndrome scored lower than typically developed ones. These findings could be used for educational programs focused on creativity in the school-context and useful both for disabled and typically developed children.

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Keywords: Down syndrome, cognitive levels, divergent thinking, Italian children;

1. Introduction

Divergent thinking has been widely studied in talented and gifted individuals as a typical characteristic of people with high mental functioning and adequate ability in selection of the most useful cognitive strategies to solve problems (Guilford, 1950; Torrance, 1962; Runco, 2007). This type of thinking has been rarely examined in children and adolescents with genetic syndrome, but more frequently in individuals with developmental delays, intellectual disabilities, or sensorial deficits. For example, in relation to learning disability, Tarver, Ellsworth and Rounds (1980)

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compared a group of learning disabled children with a group of typically developed ones at four grade levels in relation to some measures of figural and verbal creativity: learning disabled children performed higher than the others on figural originality at all grade levels, while typically developed children performed higher than the others on figural elaboration and verbal creative tasks at all grade levels. Recently, De Caroli and Sagone (2010a) found that learning disabled children, matched with typically developed children by means of cognitive tasks, scored lower on flexibility and elaboration than the control group at the pre-operational cognitive level; additionally, learning disabled children obtained lower scores than typically developed ones on flexibility, originality, elaboration, and creative verbal production at the concrete operational cognitive level. Furthermore, in a study carried out on the relationship between mental synthesis and creative thinking in learning disabled children, De Caroli and Sagone (2010b) found that disabled children scored lower on two operations of mental synthesis (that is, modification of dimension and superimposition of ideational product), but higher on the capacity to shift mental set, produce novelty, and enrich ideas than control group; also, the more learning disabled children scored highly in mental synthesis, the more they were able in the production of unfamiliar and unobvious things. In reference to a specific learning disability, Cockcroft and Hartgill (2004) examined creative performances in children with dyslexia (from 4- to 7-grade) and in children without dyslexia at the same age, revealing that the former were significantly better at generating a large quantity of ideas in all grades and, only in 6-grade, produced more original responses than the latter.

As regards sensorial deficit, some investigators pointed out that deaf children's poor performance on nonverbal tasks of creative thinking was linked to their conceptual concreteness and rigidity (Singer & Lenahan, 1976; Ebrahim, 2006). Horrocks and Pang (1968) found that deaf students scored quite equally as hearing students on fluency and originality, but scored higher on elaboration. Kaltsounis (1970) compared the creative thinking abilities of deaf and hearing students and underlined that deaf students exceeded their hearing age-mates on measures of figural fluency and originality, while hearing students performed better than deaf ones in figural flexibility. As reported by Johnson (1990), deaf adolescents with intellectual disability scored higher on fluency, but lower on originality, than hearing peers. More recently, Stanzione, Perez and Lederberg (2012) noted that deaf students were more creative on figural tasks of divergent thinking, but less creative on the verbal tasks than hearing ones.

With reference to autistic spectrum disorders, Boucher (1988) compared a small group of high-functioning autistic children with another small group of typically developed children, balanced for age and vocabulary level, in relation to creative abilities in word fluency tasks; results indicated that both groups performed equally well when generating words in response to familiar category cues, but autistic children performed significantly less well than control ones when generating miscellaneous words. As noted by Craig and Baron-Cohen (1999), children with autism and Asperger syndrome were impaired in the parallel lines task, but children with Asperger syndrome performed better than the others in the incomplete figures task; additionally, both children with autism and Asperger syndrome produced significantly fewer and statistically rare responses and generated responses from fewer categories than typically developed children. According to these authors, the creativity of children with autism and Asperger syndrome tended to be more reality-based rather than imaginative. More recently, Liu, Shih, and Mac (2011) investigated whether children with Asperger syndrome showed greater competence in creativity than typically developed peers and examined the relationship between nonverbal creativity and nonverbal IQ and vocabulary size, using the exercises in divergent thinking and feeling from a creativity assessment packet (see Williams, 1980). The results revealed that children with Asperger syndrome scored significantly higher in originality and elaboration than their peers. Nonverbal divergent thinking was correlated to nonverbal IQ for children with Asperger syndrome which tended to draw the 12 incomplete figures mostly in the areas which interested them.

Consistent with the same empirical framework represented by factorial model of Williams (1969) and the idea to deepen the analysis of creativity also in children with genetic syndrome, we focused on comparing the factors of divergent thinking between children with Down syndrome and children with typical development. We expected that children with Down syndrome will perform lower on creative tasks than children with typical development at the same cognitive level.

1.1. Hypotheses

We expected that: H_1) children with Down syndrome will perform lower than typically developed children on the ability to produce a large number of ideas from a given stimulus (that is, fluency); H_2) children with Down

syndrome will perform lower than children with typical development on the ability to change mental set, passing from one category to another (that is, flexibility); H_3) children with Down syndrome will perform lower than typically developed children on the ability to think about original and unobvious ideas for creating novelty (that is, originality); H_4) children with Down syndrome will perform lower than children with typical development on the ability to elaborate new ideas, enriching with details the final product (that is, elaboration); H_5) children with Down syndrome will execute lower than typically developed children on the verbal performance (that is, on the task of titles production).

1.2. Participants

Sixty-three children participated in this investigation and were divided into two groups: 30 children with typical development as control group (Gr-TD: *M*=6,7, *sd*=.80; range 5 yrs. 8 mo. - 8 yrs. 3 mo.) and 33 children with Down syndrome (Gr-DS: *M*=8,3, *sd*=2.3; range 6 yrs. 3 mo. - 10 yrs. 6 mo.). Both groups were chosen from all classes of two Primary Public Schools in Catania (Sicily, Italy). Each child with Down syndrome was matched with each typically developed child in relation to the cognitive level measured with Logical Operations Tasks elaborated by Vianello and Marin (1997). These criteria were used to obtain a group of children with Down syndrome comparable to children with typical development, independently by chronological age and IQ.

Six children, five with typical development and two with Down syndrome, were excluded by total sample because of their incomplete performance. Parental consent was obtained before to start the investigation.

1.3. Measures and procedure

1.3.1. Test of Divergent Thinking

The first measure is constituted by the Italian version of Test of Divergent Thinking (Williams, 1994), a test formed by 12 frames containing incomplete graphic stimuli shown to children who were asked to draw a picture. This test has been widely used in Italian school-context with different age-sample (De Caroli, 2009; De Caroli & Sagone, 2010a; De Caroli & Sagone, 2010b).

The following five scores were utilized as indicators of creative performance: fluency, flexibility, originality, elaboration, and production of titles. The fluency score was the total number of significant and meaningful pictures created by participants (range 1-12 points). The flexibility score was the number of changes of ideas from one category to a different one (range 1-11 points). The originality score was the total number of pictures drawn inside or outside each incomplete stimulus placed in the frames (range 1-36 points); one point was assigned to each picture drawn outside the stimuli, 2 points to each picture drawn inside the stimuli, and 3 points to each picture drawn both inside and outside the incomplete stimuli. The elaboration score was the number of asymmetric pictures drawn by children (range 1-36 points): zero points were assigned to the symmetrical pictures, one point to the asymmetric pictures drawn outside the incomplete stimuli, 2 points to the asymmetric pictures inside the incomplete stimuli, and 3 points to the asymmetric pictures drawn both inside and outside the stimuli. Finally, the score of the production of titles was the sum of points assigned to each title produced by children: one point was assigned for simple titles, 2 points for titles with qualifying and descriptive adjectives, 3 points for imaginative titles indicating something beyond the picture drawn by participants (range 1-36 points).

1.3.2. Logical Operations Tasks

The second measure is constituted by the Logical Operations Tasks (Vianello & Marin, 1991) applied to measure the cognitive level of each child in the area of seriation, numeration, and classification, with 6 tasks of increasing difficulty for each area. The task of simple seriation consisted of ordering sticks of different size from the shortest to the longest ones or vice versa (seriation); the task of constancy of number consisted of matching each green token to each red token; after carrying out this matching task, the experimenter arranged each green token in a visible way for the child and asked the child to recognize the conservation of number, that is, the equal number of red tokens (numeration); the task of grouping of tokens by size, color, or form (classification) consisted of classifying and putting together the given token by one of these criteria. Each task was administered to children

respecting the order of difficulty of single tasks and noticing the solution, individually during school time and in a room specifically set aside for this study.

1.4. Data analysis

The analysis of the statistical significance of results was carried out using SPSS 15 and applying *t* for paired sample with the type of group (Gr-DS vs. Gr-TD) as independent variable and cognitive levels and mean scores obtained by children in each factor of test of creative thinking as dependent variables. Regarding cognitive levels, we analysed the "concrete operational tasks" (De Caroli, Licciardello, & Sagone, 2011) in which children needed to have reached typical cognitive competences of operational thinking in order to pass. We allocated each child in one of the three cognitive levels employing the following criteria: a) *pre-operational cognitive level*, if children passed fewer than 3 concrete operational tasks; b) *intermediate cognitive level*, if children passed from 3 to 5 concrete operational tasks with at least one for each area; c) *concrete operational cognitive level*, if children passed at least 6 concrete operational tasks balanced in the three areas.

2. Results

Descriptive analyses were carried out in relation to mean scores of creative performance obtained for each cognitive level (Table 1). Results showed that, at the pre-operational and intermediate cognitive level, children with Down syndrome (Gr-DS) and children with typical development (Gr-TD) equally scored on fluency, flexibility, originality, and elaboration. At the concrete operational cognitive level, differences between the two groups were found only in relation to the production of titles ($t_{(13)}$=-4.61, p<.001): children with Down syndrome scored lower than the others on the verbal performance.

Table 1: Mean scores on factors of divergent thinking – Comparison between Gr-DS and GR-TD

Factors of divergent thinking	Type of group	Pre-operational level (n=32)		Intermediate level (n=16)		Concrete operational level (n=15)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Fluency	Gr-TD	12,00	,00	12,00	,00	12,00	,00
	Gr-DS	11,75	1,00	10,78	1,86	11,25	1,39
Flexibility	Gr-TD	8,25	1,24	8,29	1,50	8,43	,79
	Gr-DS	7,75	1,73	8,56	1,74	8,50	1,78
Originality	Gr-TD	24,38	2,68	24,29	6,13	24,14	6,01
	Gr-DS	26,88	4,86	26,67	6,98	22,00	7,64
Elaboration	Gr-TD	8,50	3,22	8,00	3,51	8,86	2,41
	Gr-DS	9,44	3,76	10,11	3,41	8,25	3,58
Titles production*	Gr-TD	22,06	6,72	20,29	5,31	23,57	5,97
	Gr-DS	17,38	6,26	20,33	6,80	13,50	1,60

* Level of significance for p<.001 at concrete operational level

3. Conclusion

The main purpose of this research was the analysis of divergent thinking in a group of children with genetic syndrome (comparable with one of typically developed children) because of paucity of empirical findings by investigators in Italian school-context. We predicted that children with Down syndrome would perform lower on creative tasks than children with typical development at the same cognitive level. This general hypothesis was marginally confirmed: results showed that, at the pre-operational and intermediate cognitive level, children with Down syndrome and those with typical development equally scored on fluency (H_1), flexibility (H_2), originality (H_3), and elaboration (H_4), whereas, at the concrete operational cognitive level, significant differences between the two groups emerged only in relation to verbal production (H_5). Only in this last case, disabled children scored lower

than typically developed ones.

The absence of previous evidences in this specific topic of research, incomparable with other results both for the type of assessment and for the typology of sample, made it difficult to reach unique assumptions referred to creative performances of disabled individuals. Probably, one of the most common false beliefs, that could justify the reduced diffusion of this analysis in Italian school-context, is deducible by the idea according to which divergent thinking is even considered as a genial and typically developed characteristic in exceptional and gifted individuals. Personally, we considered divergent thinking as a cognitive resource useful to solve problems and adapt oneself to the environment, also independently by typical or atypical development and directly linked to specific educable competences. These findings could be used for educational programs focused on creativity in the school-context and useful both for disabled and typically developed children.

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