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Evaluation of children with Attention Deficit Hyperactivity Disorder and Specific Learning Disability on the WISC and Cognitive Assessment System (CAS)

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Abstract

The diagnoses of the Attention Deficit Hyperactivity Disorder (ADHD) and Specific Learning Disabilities (SLD) are often based on IQ-connected instruments. The preponderance of data supports the opinion that this kind of tests shouldn't be relied upon for ruling in or out the diagnosis of ADHD and SLD. The Planning, Attention, Simultaneous, Successive Theory is an alternative to traditional IQ. The purpose of this study is to examine differences in cognitive performance between samples of ADHD and SLD children. The results suggest that Wechsler scores show minimal difference but CAS scores appear sensitive to the cognitive processing difficulties experienced by children.

Keywords: Cognitive Processes; ADHD; SLD; Intelligence; PASS Theory; Assessment.

1. Introduction

Attention Deficit Hyperactivity Disorder (ADHD) and Specific Learning Disabilities (SLD) are among the most challenging disorders in the field of psychology and education. Their diagnosis is commonly based on the administration of IQ-related instruments (Pfeiffer et al., 2000; Sattler, 2002), even though various studies reveal that it is difficult to differentiate these disorders on the basis of intelligence measurement (Gresham, Vellutino, 2010; Kaufman & Lichtenberger, 2000). In fact, a large body of research shows that these tools are not suitable to place the subjects in different diagnostic categories although they are widely used and instead it is necessary to use an approach that can identify the cognitive features related to these disorders, redefining the concept of intelligence (Hale, et al., 2010; Naglieri, 2003). The cognitive approach – alternative to the classic IQ definition – allows a

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better understanding of intelligence (Das, 2002; Kaufman, & Kaufman, 2001), has a greater diagnostic utility (Ceci, 2000) and would be able to provide useful information for the intervention in schools and treatment (Naglieri, & Johnson, 2000).

In the case of children-suspected ADHD, and although the administration of a classic intelligence scale such as WISC (in its different versions) may provide useful information about the intellectual abilities of these subjects, Kaufman and Lichtenberger (2000) pointed out that it cannot be used as a diagnostic tool. Actually, subjects affected by ADHD experience behavioural and academic problems that clearly lead to underlying cognitive factors such as executive functions (Mattison, & Mayes, 2010) that cannot be measured through traditional IQ tests like WISC (Dennis, et al., 2010; Barkley, 1997;1998). As emphasized by Jepsen, Fagerlund, & Mortensen (2009), tests of general intelligence are not sensitive to the cognitive problems experienced by children with ADHD. Thus, in order to be sensitive to the cognitive problems observed in several children affected by ADHD, an ability test should be able to measure what has been described as executive functions or cognitive processes. Neuropsychological researchers have described ADHD as an executive control problem (Hummer, et al., 2010; Oosterlaan, Scheres, & Sergeant, 2005; Nigg, 2001; Pennington & Ozonoff, 1996), and Goldberg (2001) and Thompson-Schill, Ramscar, & Chrysikou (2010) suggested that ADHD is a mild form of frontal lobe dysfunction that impairs goal-directed planning behaviour. If ADHD is seen as a problem of inhibition, planning and control, then it is logical that tests of general intelligence, which were not designed to measure these cognitive processes (Wasserman, 2002;Naglieri, & Goldstein, 2009), provide only limited aid to the diagnosis of this disorder.

The evaluation of SLD is also open to similar doubts. The subjects are commonly diagnosed on the basis of a discrepancy criterion between intelligence, measured through IQ-related tools, and academic achievement, without specific sensory impairment or environmental deficit (Sattler, 2002). Methods inspired by a discrepancy criterion do not seem suitable to indicate intervention or to improve the abilities and performance of the subjects (Kavale, 2005). In fact, tests of general intelligence have been criticized for being poorly sensitive to problems often experienced by the affected children (Vellutino, Scanlon, & Lyon, 2000; Katz, Goldstein, Beers, 2001). Despite the widespread use of the general intelligence model and attempts to identify children with learning disabilities using scale or subtest profiles, researchers have concluded that these methods are not effective (Gunderson, & Siegel, 2001; Kavale & Forness, 2000; Kavale & Forness, 1984). Kaufman and Lichtenberger (2000) showed that the WISC-III subtest profile is not informative enough to allow a differential diagnosis. Several Authors argued that the general intelligence model is insensitive to the cognitive problems experienced by SLD children because it does not measure any basic psychological processes related to learning failure and alternative approaches seem to be necessary (Goldstein, Naglieri, & DeVries, 2011; Fletcher, Coulter, & Reschly, 2004; Naglieri, 2000).

A cognitive processing approach may provide greater sensitivity to the problems of children both affected by ADHD (Goldstein, & DeVries, 2011; Naglieri, & Das, 2005) and SLD (Goldstein, 2011; Naglieri, 2003a). In this respect, the Planning, Attention, Simultaneous and Successive (PASS) theory as operationalized by the Cognitive Assessment System (CAS; Naglieri & Das, 1997a, b) seems to provide an attractive diagnostic tool for children affected by ADHD and SLD. The PASS theory, referring to the work of Lurija (1966), stands as neuropsychological theory, able to explain the cognitive functioning and useful in the assessment of learning and attention disorders (Naglieri, & Goldstein, 2011). Several Authors investigated the role of the four cognitive processes in ADHD; the subjects affected by this disorder obtain a lower score of Planning (Papadopoulos, Panayiotou, Spanoudis, & Natsopoulos, 2005; Naglieri, Salter, & Edwards, 2004; Naglieri, Goldstein, lseman, and Schwebach, 2003; Dehn, 2000; Paolitto, 1999) and Attention (Van Luit, Kroesbergen, & Naglieri, 2005) and many researchers pointed out the utility of CAS in the assessment of the different types of ADHD (Goldstein, & Naglieri, 2008).

Other studies (Das, Naglieri, & Kirby, 1994; Naglieri, 1999; Naglieri, 2001; Naglieri, Salter, & Edwards, 2004) highlighted the importance of Successive process for the diagnosis of SLD. Children affected by SLD showed indeed a Successive low score in this kind of measurements. These results were further supported by recent studies on clinical groups (Naglieri et al. 2003; Joseph, McCachranand, & Naglieri, 2003b) and on specific skills such as those relating to the arithmetic abilities (Kroesbergen, VanLuit & Naglieri, 2003b; Kroesbergen, Van Luit, Naglieri, Taddei & Franchi, 2009). In the Italian context, Taddei, & Venditti (2010) underlined that subjects affected by ADHD have some dysfunction in Planning and Attention processes and that different cognitive profiles suggest different types of ADHD. The same researchers also highlighted the utility of the PASS theory for the assessment of SLD, through the study of a clinical group (Taddei, Venditti, & Cartocci, 2009; Taddei, Venturini, Chillè, 2006).

Although these studies suggest that the PASS theory may provide an effective alternative to the general intelligence model, further research is needed. The aim of this study was to explore the performance of children diagnosed with ADHD and SLD using a traditional model of intelligence and the PASS theory in order to determine: a) the IQ independence from the PASS processes, and b) their ability to identify and discriminate the two diagnoses. Since the PASS method involves measurements of cognitive processing, we expect to observe significant differences between the two clinical groups of subjects. In particular, based on previous results, we can predict that children with reported ADHD problems would evidence low performance on Planning and Attention tests, whereas students affected by SLD would be less performing in Successive processing.

2. Method

2.1 Participants

36 children were analyzed (24 males and 12 females) with ages ranging from 6 to 14; 18 children (13 males and 5 females) were previously diagnosed with Attention Deficit/ Hyperactivity Disorder (ADHD) with a mean age of 9.2 and SD 2.2, and 18 children (11 males and 7 females) were previously diagnosed with Specific Learning Disability (SLD) with a mean age of 9.4 and SD 2.3. Diagnoses were provided for all conditions on Axis I of the DSM-IV-TR (American Psychiatric Association, 2000). Subjects were receiving treatment at the local Neuropsychiatric Services of Italian National Health System (NHS), they were signalled because of the seriousness of their problems and subjected to an overall assessment by psychiatrists, psychologists and professionals in the mental health service. The presence of a neurologic aetiology (e.g. head trauma) or of a Pervasive Developmental Disorder and comorbidity was used as an exclusion criterion.

2.2 Materials

The Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974) in its Italian version (Orsini, 1993) was administrated. The WISC-R is organized into two scales (Verbal IQ and Performance IQ) and a Full Scale standard score. The standardized data (obtained on a sample of 1944 children ranging in age from 6 to 16 years old) was used as a comparison group. The PASS processes were assessed using the Cognitive Assessment System (CAS; Naglieri, & Das, 1997a) in its Italian version (Taddei, & Naglieri, 2005). The CAS is organized into four scales (Planning, Attention, Simultaneous and Successive) according to the PASS theory, and has a Full Scale standard score. The normative data of the Italian sample, standardized on 806 subjects aged from 5 to 17 years old, was used as a comparison group.

2.3 Procedure

The entire WISC-R and the standard battery (12-subtest) of the CAS were administered to all participants by trained examiners. Data were analyzed utilizing SPSS version 18.0. Means and SDs were computed for ADHD and SLD children.

The differences between the mean standard scores (obtained from test manuals) were examined by computing d ratios, which compare the groups in standard deviation units (Cohen, 1988) using the formula:

$$(X1 - X2) / SQRT [(n1 * SD^2 1 + n2 * SD^2 2)/(nl + n2)].$$

The d ratios were interpreted using Cohen's (1988) guidelines of .2 to .4, .5 to .7, and .8 and above as small, medium and large effect sizes respectively. The significance of the mean differences between the children with ADHD and the children with SLD was examined utilizing a MANOVA, with the child's diagnosis as the fixed factors and the WISC-R and CAS scores as dependent variables.

3. Results

Means and standard deviations of WISC-R and PASS scores are provided for the two groups in Table 1. Differences between group means are also presented for the Verbal IQ, Performance IQ and the Full Scale IQ of the WISC-R and the Planning, Simultaneous, Attention and Successive PASS scales and the CAS Full Scale score. The WISC-R standard scores for the ADHD group ranged from 89 on Full Scale to 90.28 on Performance IQ. The SLD

group scores ranged from 89.05 on Verbal IO to 96.17 on Performance IQ. The effect size was small between the two groups for Performance IQ (d = 0.39). There was no significant difference between the two groups on Verbal IQ and Full Scale IQ. There was also a medium effect size for Verbal IQ (d = 0.67), Performance IQ (d = 0.65), and Full Scale IQ (d = 0.73) between the ADHD sample and the standardization sample, and a medium effect size, respectively, for Verbal IQ and Full Scale (d = 0.73, and d = 0.52), and a small effect for Performance IQ (d = 0.26) between the SLD sample and the standardization sample.

Table 1: Means, Standard Deviations and d-ratios for WISC-R and CAS scores.

	Descriptive Analyses				Difference between mean – Cohen's d ratios		
	ADHD		SLD		ADHD vs. SLD	ADHD vs. Normative Mean	SLD vs. Normative Mean
	M	SD	M	SD			
WISC-R							
Verbal IQ	90.00	16.16	89.05	18.24	- 0.5	0.67**	0.73**
Performance IQ	90.28	17.71	96.17	11.64	0.39*	0.65**	0.26*
Full Scale IQ	89.00	17.29	92.17	15.28	0.19	0.73**	0.52**
CAS							
Planning	73.00	11.68	93.78	13.81	1.62***	1.81***	0.41*
Simultaneous	92.39	15.52	89.61	9.79	- 0.21*	0.51**	0.70**
Attention	68.72	10.37	90.44	9.96	2.14***	2.10***	0.64**
Successive	95.66	10.90	75.44	13.03	- 1.68***	0.29*	1.64***
Full Scale	77.83	10.53	84.28	11.76	0.58**	1.49***	1.05***

Note: d ratios are designed as *= small (.2-.4); **= medium (.5-.7); and ***= large (.8 and above).

The PASS standard scores ranged from a low of 68.72 on Attention to a high of 95.66 on Successive for the ADHD sample, and they ranged from 75.44 on Successive to 93.78 on Planning for the SLD sample. The effect size was large between the two groups, respectively, for Planning, Attention and Successive processing (d = 1.62, d = 2.14 and d = -1.68). However, the effect sizes were small for Simultaneous process (d = -0.21) and medium for Full Scale (d = 0.58). There was also a large effect size for Planning (d = 1.81), Attention (d = 2.10), and Full Scale (d = 1.49) between the ADHD sample and the standardization sample, and a large effect size for Successive (d = 1.64) and Full Scale (d = 1.05) between the SLD sample and the standardization sample. A MANOVA was conducted to compare the WISC-R and PASS standard scores for the ADHD and SLD samples. It was found that the overall effect between groups was significant, Wilks' $\lambda = .18$, $F_{(2,27)} = 15.73$; $p < .05$. No differences between the two groups in the WISC-R scales were founded. Instead, the PASS Scale standard scores of the two groups were significantly different for Planning, $F = 23.74$, $p < .05$, for Attention $F = 41.09$, $p < .05$, and for Successive $F = 25.51$, $p < .05$.

3 Discussion

The results of this study allow to show a mild sensitivity of WISC-R to discriminate subjects with ADHD or SLD, especially considering cognitive functioning, as well as the risk of overlapping the diagnosis for low differences between WISC-R profiles. Although Wechsler scales have been widely used by clinicians during ADHD diagnosis (Pfeiffer et al., 2000) and, referring to a discrepancy criterion, for the SLD diagnosis (Sattler, 2002), it seems indeed necessary to recall that, as pointed out by Wasserman (2002), these have not been developed as a specific tool for the diagnosis of these disorders. Moreover, the general intelligence model that has inspired it provides a little help in identifying individuals with ADHD or SLD (Naglieri, 2003). Although the data show a little

capacity of WISC-R to differentiate the examined subjects from the normal population, the evaluation of PASS processes seems to be more relevant to differentiate these subjects, suggesting that the adoption of a neuropsychological perspective allows a better understanding of these disorders. Specifically, it is noted that subjects with ADHD show lower scores in Planning process, consistent with previous research (Goldstein, & DeVries, 2011; Van Luit, Kroesbergen & Naglieri, 2005; Paolitto, 1999), but also in Attention process. The particular role of Attention in ADHD, already underlined in other Italian study (Taddei, & Venditti, 2010), could be explained by the seriousness of clinical situation of children examined although further research should investigate this difference. On the opposite, subjects affected by SLD show lower performances in Successive process, as already evidenced by Taddei, Venditti, & Cartocci (2009), Naglieri, Salter, & Edwards (2004) and Naglieri (2001).

These results allow to underline the usefulness of understanding cognitive functioning to assess attention and learning disorders; the evaluation of cognitive processes could be a diagnostic criterion for ADHD (Naglieri, & Das, 2005; Goldstein, & DeVries, 2011), to detect the different types of ADHD (Taddei, & Venditti, 2010) and it could provide a better understanding of the reason why some children experience academic difficulties related to SLD (Goldstein, 2011; Naglieri, 2003a). The assessment of cognitive processes is also important to detect different diagnostic frameworks and seems to be important to keep in mind that lower performances in Attention and Planning or in Successive scales are not, by themselves, a sufficient condition for the diagnosis of ADHD and SLD respectively; the clinician must always integrate these results with other measures relevant for the assessment of the subject.

The main limitation of this study is the small number of participants (18 children affected by ADHD and 18 children affected by SLD). Although the number of participants included in this study was not large, the children were carefully diagnosed and the groups were carefully matched.The fact that the different scales discriminate the subjects in such a strong way could be due to the seriousness of their clinical situation. Hence, it seems important to consider that all of them are receiving treatment at NHS neuropsychiatric services therefore underlying the high degree of seriousness of their clinical situation.

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