Vineland-II Adaptive Behavior Profile of Children with Attention-Deficit/Hyperactivity Disorder or Specific Learning Disorders

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Disorder or Specific Learning Disorders

Abstract

Background. The evaluation of adaptive behavior is informative in children with attention-deficit/hyperactivity disorder (ADHD) or specific learning disorders (SLD). However, the few investigations available have focused only on the gross level of domains of adaptive behavior.

Aims. To investigate which item subsets of the Vineland-II can discriminate children with ADHD or SLD from peers with typical development.

Methods and Procedures. Student's *t*-tests, ROC analysis, logistic regression, and linear discriminant function analysis were used to compare 24 children with ADHD, 61 elementary students with SLD, and controls matched on age, sex, school level attended, and both parents' education level.

Results. Several item subsets that address not only ADHD core symptoms, but also understanding in social context and development of interpersonal relationships, allowed discrimination of children with ADHD from controls. The combination of four item subsets (Listening and attending, Expressing complex ideas, Social communication, and Following instructions) classified children with ADHD with both sensitivity and specificity of 87.5%. Only Reading skills, Writing skills, and Time and dates discriminated children with SLD from controls.

Conclusions. Evaluation of Vineland-II scores at the level of item content categories is a useful procedure for an efficient clinical description.

Keywords: Adaptive behavior profile, ADHD, SLD, Vineland, matching

What this paper adds?

The unique contribution of this study can be summarized as follows. (1) For the first time, the adaptive behavior profile of children with ADHD or SLD has been investigated using the updated Vineland-II. (2) Rigorous strategies have been used to establish equivalence (i.e., matching) of children with and without ADHD or SLD and to rule out the effects of other variables that could influence adaptive behavior. (3) The analyses went beyond the Vineland-II total domain and subdomain scores and considered specific item subsets to help in diagnosis and intervention.

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1. Introduction

Adaptive behavior has been defined as the collection of learned "conceptual, social, and practical skills" (Luckasson et al., 2002) performed by people in their everyday lives (Schalock, et al., 2010; Tassé et al., 2012). The Vineland Adaptive Behavior Scale (VABS; Sparrow, Balla, & Cicchetti, 1984) has been proposed as one of the most valid and reliable tools for the evaluation of adaptive behavior skills (Balboni, Pedrabissi, Molteni, & Villa, 2001; Schalock et al., 2010). These properties have been confirmed for the revised second (Vineland-II; Sparrow, Cicchetti, & Balla, 2005) and third (Vineland-3; Sparrow, Cicchetti, & Saulnier, 2016) editions. The four scales of Communication, Daily Living Skills, Socialization, and Motor Skills allow for the measurement of all adaptive behavior skills, as well as motor skills, by means of a semi-structured interview with the individual's caregiver.

Traditionally, the assessment of adaptive behavior has been associated with a diagnosis of intellectual disability disorder (Heber, 1961; Schalock et al., 2010). However, the assessment has also proved useful for planning personalized treatments for individuals with other disorders, for instance, autism spectrum disorder (e.g., Balboni, Tasso, Muratori, & Cubelli, 2016; Kanne et al., 2011).

The evaluation of adaptive behavior also appears to be informative in children with attention-deficit/hyperactivity disorder (ADHD) or specific learning disorder (SLD), both neurodevelopmental disorders (Leigh, 1987; Roizen, Blondis, Irwin, & Stein, 1994). ADHD is characterized by a persistent pattern of inattention, disorganization, and/or hyperactivity-impulsivity, which interferes with functioning or development (American Psychiatric Association, 2013). Social dysfunctions and difficulties in social communication are generally associated with ADHD (Nijmeijer et al., 2008), starting in early childhood and in

most cases persisting into adolescence and adulthood (Barkley, Fischer, Smallish, & Fletcher, 2002). Recently, deficits in social cognition and pragmatic language have been suggested as causes of these social dysfunctions (Caillies, Bertot, Motte, Raynaud, & Abely, 2014; Staikova, Gomes, Tartter, McCabe, & Halperin, 2013; Uekermann et al., 2010). SLD concerns difficulties in learning and using academic skills (e.g., reading, writing, and mathematics), and affects academic and occupational performance and/or daily life activities (American Psychiatric Association, 2013).

Although deficits in adaptive behavior are considered peripheral in ADHD and SLD, they can provide additional information about the underlying disorder and may be useful in diagnostic and therapeutic stages. However, very few studies have investigated the adaptive behavior profile of children with ADHD or SLD, and findings are far from conclusive (e.g., Clark, Prior, & Kinsella, 2002; Ditterline, Banner, Oakland, & Becton, 2008).

Typically, investigations of adaptive behavior in ADHD have involved comparisons of children with ADHD and peers with other disorders occurring in isolation or associated with ADHD. The main aim was to identify the adaptive behavior domains that distinguish ADHD from the other pathologies, e.g., autism spectrum disorder (Ashwood et al., 2015; Magnúsdóttir, Saemundsen, Einarsson, Magnússon, & Njardvik, 2016; Stein, Szumowski, Blondis, & Roizen, 1995), oppositional defiant/conduct disorder (Clark et al., 2002), obsessive compulsive disorder (Sukhodolsky et al., 2005), or prenatal alcohol exposure (Crocker, Vaurio, Riley, & Mattson, 2009).

In just few studies, children and adolescents with ADHD or SLD have been compared with peers with typical development. Participants with ADHD showed delays in all three domains of conceptual, social, and practical adaptive behavior skills (Clark et al., 2002; Crocker et al., 2009; Sukhodolsky et al., 2005). In contrast, children with SLD showed deficits that were specific to the conceptual adaptive behavior domain and affected all areas

related to functional academic skills (Fagerlund et al., 2012; Leigh, 1987). However, to investigate the adaptive behavior profile deeply, some methodological concerns should be addressed.

To understand the adaptive behavior of children with behavioral and cognitive impairments, researchers should match the profiles of these children with those of typically developing peers on the relevant socio-demographic variables (i.e., age, sex, socio-cultural level, and school level attended). As suggested by Kover and Atwood (2013) and Steiner, Cook, Shadish, and Clark (2010), for each matching variable, equivalence between the clinical and control groups should be based not only on p values, but also on effect sizes (Cohen's d within 0.10) and on variance ratios (between 0.9 and 1.25). In previous investigations with matched clinical and typical development groups (Clark et al., 2002; Crocker et al., 2009; Fagerlund et al., 2012; Sukhodolsky et al., 2005), the matching criteria suggested by Kover and Steiner were not met for all of the relevant socio-demographic variables. Moreover, equivalence was based on the mean of the matched variables. A customary group-matching procedure is to exclude participants iteratively, from one or both clinical-control groups, until matching criteria are fit. In this way, however, the exclusion of participants can compromise the power of statistical procedures. Moreover, this approach prevents any data analysis procedure that takes into account the relationship between the dependent variables. To overcome these methodological concerns, the one-to-one matching procedure is preferable (e.g., Tabachnick & Fidell, 2013): each participant in the clinical group is associated with a control participant with the same or similar values of all the matching variables.

In the present study, we examined the adaptive behavior profiles of children with ADHD or SLD selected for the Italian standardization of the Vineland-II Survey Interview Form (hereafter, Vineland-II; Balboni, Belacchi, Bonichini, & Coscarelli, 2016). We

compared children with ADHD or SLD and peers with typical development matched one-to-one on relevant socio-demographic variables. The main goal was to identify the subsets of items that could discriminate the clinical and control groups. Moreover, we aimed to identify the combination of item subsets that renders the best classification of participants. To our knowledge, this procedure has never been employed with the Vineland-II to investigate the profiles of children with ADHD or SLD. To identify which specific areas of adaptive behavior are more impaired, researchers should consider not only the total scores on the Vineland-II domains and subdomains, but also the scores on the item subsets that measure specific adaptive behavior skills (Balboni, Tasso, et al., 2016; see also, Paul et al., 2004).

2. Method

2.1 Participants

From the database used for the Italian standardization of the Vineland-II (Balboni, Belacchi, et al., 2016), we selected the records of 170 Italian children: 24 children with a diagnosis of ADHD (age range: 5–14 years), 61 children with a diagnosis of SLD (age range: 6–11 years), and 85 controls with typical development (age range: 5–14 years). Control children were matched one-to-one on relevant socio-demographic variables. For each child with ADHD or SLD, a peer with typical development was selected with a comparable age (mean difference = 2.00 months [SD = 2.40]; median = 1.10; range: .03–14.03 months), and same biological sex, school year attended, and both parents' education level (Table 1). All participants were Italian native speakers and attended a regular education program. They all lived with their families, except two children with ADHD, one who lived in a foster home and one in a group home.

Children received the diagnosis of ADHD at a mean age of 9 years (range: 5–15). No child had a dual diagnosis of ADHD and SLD. An oppositional defiant disorder was diagnosed in seven children with ADHD. Only two children were on medication for ADHD

symptoms. For 36 children with SLD (59%), information about the impaired domain was available: 24 were impaired in reading, 3 in written expression, 7 in both reading and written expression, and 2 in reading, written expression, and mathematics.

The clinical participants had been recruited in several Italian centers specializing in the assessment of children with developmental disabilities, where they had received the diagnosis of ADHD or SLD according to the DSM-IV-TR criteria (American Psychiatric Association, 2005) and on the basis of standardized instruments, direct observation, and parent interview. The diagnosis of the ADHD disorder was based on a testing battery assessing attentional and executive functions and on questionnaires given to parents and teachers to evaluate the presence of psychological problems. In cases of concern, all children underwent further testing to evaluate the presence of other mental disorders. Children with a prenatal alcohol exposure or a diagnosis of any major disorders (e.g., intellectual disability or autism spectrum disorder) were not present. Twelve children with ADHD were attending a self-control training program; their parents were attending a parent training program.

Twenty-one individuals with ADHD (87%) and 20 with SLD (33%) underwent the Wechsler scales (Wechsler, 1991, 2003) and 10 with SLD (16%) the Colored Progressive Matrices (Raven, Raven, & Court, 1998). The IQ mean (SD) was 99.43 (15.68) (range: 68–127) for the children with ADHD; 101.38 (9.01) (range: 88–119) and 121.40 (12.17) (range: 94–133) for those with SLD evaluated with the Wechsler scales and the Colored Progressive Matrices, respectively.

The participants with typical development had been recruited from different areas in Italy. None of them presented actual or previous signs of developmental abnormalities or neuropsychiatric disorders. As there were no hints of specific disorders, cognitive and intellectual abilities were not assessed. For all participants, parental informed consent was obtained. No monetary reimbursement was given.

<Insert Table 1 here>

2.2 Instruments and Procedure

The Vineland-II scales assess adaptive behavior in terms of abilities for personal and social functioning in different domains of everyday life. Specifically, the four different domains assess each developmental step from 0 to 90 years in communication, socialization, and daily living adaptive skills, and from 0 to 6 years in motor adaptive skills. Each domain comprises subdomains (Receptive, Expressive, and Written skills in Communication; Personal, Domestic, and Community skills of Daily Living; Interpersonal relationship, Play and leisure time, and Coping skills of Socialization; and Gross and Fine Motor skills) with item sets assessing specific content areas (i.e., adaptive skills). In the present study, the scores obtained for all 47 item sets of Communication, Daily living skills, and Socialization domains were used (see supplementary material). Each item subset comprises the items that allow for measurement of that specific content category and that were identified by Sparrow et al. (2005) while developing the instrument. All sets contain 1–14 individual items (median = 6 items); possible item scores are 2, 1, or 0, and the score for each set is calculated as the mean of the individual item scores (for more detail see Sparrow et al., 2005). Scores on the Motor skills domain were not used because they were available only for the 5- and 6-year-old participants.

An Italian adaptation of the Vineland-II, approved by Pearson Editor and with excellent psychometric properties (Balboni, Belacchi, et al., 2016), was used. Trained psychologists administered the Vineland-II to the caregivers of the children of both clinical and control groups (mother [86%], father [11%], others [3%]). For more details on the data collection for the Italian standardization of the Vineland-II, see Balboni, Belacchi, et al. (2016).

2.3 Data Analysis

Before analyzing the data, according to Tabachnick and Fidell's (2013) recommendation, we checked for the presence of univariate outliers in the Vineland-II Adaptive Behavior Composite normative score within each of the four clinical and control groups. No outliers were found.

We used Student's *t*-tests for matched samples to identify the Vineland-II domains, subdomains, and item subsets on which there were statistically significant differences between the ADHD or SLD group and the corresponding control group. Given the number of comparisons with the same participants, to avoid Type I error we computed *p* values by means of the False Discovery Rate procedure (Benjamini & Yekutieli, 2001). In case of statistically significant differences, Cohen's *d* for matched samples was computed as an estimate of effect size (Cohen, 1988; Morris & DeShon, 2002).

To identify the item subsets that classified the clinical and control groups at above-chance levels, we used ROC analysis to estimate the probability of correct classification, and logistic regression to compute the percentage of participants correctly classified into each group (Tabachnick & Fidell, 2013). We then computed the total capacity for classification, i.e., the mean probabilities of correct classification and of participants correctly classified. To identify the best combination of item subsets, linear discriminant function analyses were run.

Finally, to identify the within-ADHD and -SLD group domain and subdomain profiles, we ran repeated measures multivariate analyses of variance (MANOVAs) with the normative scores obtained by each clinical group on the three domains, or on each of the three subdomains of the same domain, as repeated measures. To locate the sources of the global differences reflected by the MANOVAs, we ran repeated measures ANOVAs followed by Bonferroni's post hoc comparisons (Tabachnick & Fidell, 2013). In case of statistically significant differences, we computed η^2 for multivariate analysis, *partial η^2 (η^2_p)* for univariate analysis, and Cohen's *d* for matched sample post-hoc analysis.

In agreement with Cohen's criteria (1988), effect sizes were evaluated as negligible (η^2, η^2_p < .01; d < 0.20), small (.01 ≤ η^2, η^2_p <.06; 0.20 ≤ d < 0.50), medium (.06 ≤ η^2, η^2_p < .14, 0.50 ≤ d < 0.80), or large (η^2, η^2_p ≥.14, d ≥ 0.80).

3. Results

3.1 Vineland-II Adaptive Behavior Profile of Participants with ADHD

As shown in Table 2, children with ADHD had statistically significant lower normative scores on the Adaptive Behavior Composite (large effect) and on the following domains: Communication and its Receptive and Expressive subdomains (large effect); Daily living skills and the Domestic and Community subdomains (medium effect, but small for the Domestic); Socialization and all three subdomains of Interpersonal relationships, Play and leisure time, and Coping skills (large effect, but for the Play and leisure time medium).

<Insert Table 2 here>

3.1.1 Identification of the item subsets that discriminate ADHD and control groups. Table 3 shows the item subsets for which there were statistically significant differences between the two groups, as revealed by the Student's *t*-test, and those with discriminant ability at above-chance level, as revealed by both ROC analysis and logistic regression. For the Communication domain, the item subsets for which both these conditions were satisfied and for which the magnitude of the differences was at least medium were the three subsets of the Receptive subdomain and the following subsets of the Expressive subdomain: Interactive speech, Speech skills, and Expressing complex ideas. For the Daily living skills domain, the relevant item subsets were Money skills and Restaurant skills (Community subdomain). Finally, for the Socialization domain, the following subsets were relevant: Expressing and recognizing emotions, Social communication, and Friendship (Interpersonal relationships subdomain); Sharing and cooperating, Playing games, and Recognizing social cues (Play and leisure time subdomain); Controlling impulses, Keeping

secrets, Responsibility, and Appropriate social caution (Coping skills subdomains). In all comparisons, the ADHD group obtained lower scores. The percentage of individuals correctly classified ranged from 63.5% to 87.5%.

<Insert Table 3 here>

3.1.2 Identification of the item subset combination that best classifies participants into the ADHD or control group. To identify the best combination of item subsets, linear discriminant function analyses were run. Linear discriminant analysis requires at least five participants in each group per predictor variable (Fletcher, Rise, & Ray, 1987). Because each of the two matched groups included 24 participants, four predictors could be entered.

To select the item subsets to be used as predictors, we ordered them in one list based on the magnitude of differences found and on each subset's total capacity for classification. The first three subsets on this list were Listening and attending, Expressing complex ideas, and Social communication. Therefore, we ran discriminant analyses with these three item subsets as fixed predictors. The following five item subsets remaining from the list based on discriminant capacity were entered, one at a time, as the fourth predictor: Following instructions, Interactive speech, Controlling impulses, Expressing and recognizing emotions, and Understanding. The following combination produced the best classification results: Listening and attending, Expressing complex ideas, Social communication, and Following instructions (Wilks' λ = .43; $\chi^2[4]$ = 37.37; p < 0.001). This combination correctly classified 87.5% of children with ADHD and 87.5% of children with typical development. In children classified with ADHD, both sensitivity and specificity were 87.5%.

Only three children with ADHD were misclassified. They were males between 7 and 12 years of age, one of whom was the child living with a foster mother.

3.1.3 Identification of the within-ADHD group domain and subdomain profiles.

To investigate further the value of the identified item subset combination, we verified the agreement with the within-ADHD group domain and subdomain profiles. Repeated measures MANOVAs revealed statistically significant differences within the normative scores obtained by the children with ADHD in the Vineland-II domains as well as in the Communication, Daily living skill, and Socialization subdomains (see Table 4). Subsequent ANOVAs revealed that the children with ADHD presented the Communication < Socialization < Daily living skills domain profile; Receptive and Expressive < Written Communication subdomain profile; and Copying Skills < Interpersonal Relationships and Play and leisure time Socialization profile. Moreover, the normative score on the Community subdomain was lower than that on the Personal subdomain. The effect sizes were generally large; they were medium in only two comparisons.

<Insert Table 4 here>

3.2 Vineland-II Adaptive Behavior Profile of Participants with SLD

Comparisons of the participants with ADHD with the controls. As shown in Table 2, the SLD group obtained statistically significantly lower normative scores, with a medium effect size in the Communication domain and in the Written subdomain. Also, children with SLD obtained lower scores on the Adaptive Behavior Composite and the Receptive subdomains; however, the effect sizes were small enough that the differences should be evaluated as clinically irrelevant.

3.2.1 Identification of the item subsets that discriminate SLD and control groups.

Table 5 shows the item subsets for which there were statistically significant differences between the two groups, as revealed with the Student's *t*-test, and those with a discriminant ability at above-chance level, as revealed by both ROC analysis and logistic regression. The item subsets for which both these conditions were satisfied and for which the magnitude of

the differences was at least medium were Reading skills and Writing skills (Written subdomain) and Time and dates (Community subdomain). The fraction of individuals correctly classified ranged from 64.5% to 69.5%.

<Insert Table 5 here>

3.2.2 Identification of the item subset combination that best classifies participants into the SLD or control group. As with the previous groups, linear discriminant function analyses were run to identify the best combination of item subsets. Because the two matched groups included 61 participants each, 12 predictors could be entered. However, just for Reading skills, Writing skills, and Times and dates item subsets, there were statistically significant medium-sized differences between the two groups, and discriminant ability was at above-chance level. Therefore, we ran discriminant analyses with these three item subsets as predictors. This combination correctly classified 68.9% of participants, and, specifically, 65.6% of children with SLD and 72.1% of children with typical development (Wilks' $\lambda = .84$; $\chi^2[4] = 20.90$; $p < 0.001$). In children classified with SLD, sensitivity was 70.2% and specificity was 67.7%.

Twenty-one children with SLD were misclassified. Compared with the correctly classified children, misclassified children with SLD were older and more likely to be female, and had obtained higher normative scores on Vineland-II Adaptive Behavior Composite and domains and subdomains except the Expressive and the Interpersonal Relationship subdomains. The effect sizes were from medium to high, except for the sex comparison, for which the effect size was small.

3.2.3 Identification of the within-SLD group domain and subdomain profiles. Repeated measures MANOVAs revealed statistically significant differences within the normative scores obtained by the children with SLD in the Vineland-II domains and in the Communication subdomains (see Table 4). Subsequent ANOVAs revealed that the children

with SLD presented Communication < Daily living skills and Socialization domain profile (with at least a medium effect size). The score on the Expressive subdomain was significantly higher than that on the Written (medium effect) and Receptive (small effect) subdomains.

3.3 Comparisons between ADHD and SLD Groups Vineland-II Profiles

We also investigated the utility of the Vineland-II in discriminating ADHD and SLD groups. A Student's t-test for independent samples (with False Discovery Rate correction for multiple comparisons) was run to compare the normative scores of the two clinical groups on the Vineland-II domains, subdomains, and Adaptive Behavior Composite. We found that children with ADHD had a medium-sized score on the Adaptive Behavior Composite and on all domains and subdomains except the Written subdomain (see analysis in the supplementary material) that was significantly lower than that of children with SLD. However, based on the criteria proposed by Kover and Atwood (2013) and by Steiner and colleagues (2010) for establishing equivalence in group-matching designs, the ADHD and SDL groups did not emerge as comparable. They were equivalent only for the educational level of mothers ($\chi^2[3] = 1.01$, $p = 0.798$, Cohen's $w = 0.11$) and fathers ($\chi^2[3] = 1.19$, $p = 0.756$, Cohen's $w = 0.11$). They were not matched on age (Cohen's $d = 0.49$, SD^2_{ADHD} $/SD^2_{SLD} = 2.18$), school level attended ($\chi^2[2] = 28.81$, $p < 0.001$, Cohen's $w = 0.58$) or sex ($\chi^2[2] = 4.01$, $p = 0.045$, Cohen's $w = 0.22$). The ADHD group were significantly older, attended higher school levels and were more likely to be male.

4. Discussion

Our main goal was to identify the item subsets of the Vineland-II that could best discriminate children with ADHD or SLD and control groups of typically developing peers. To this end, following the criteria proposed by Kover and Atwood (2013) and Steiner et al. (2010) for establishing equivalence in group-matching designs, the participants of the clinical and control groups were matched one-to-one for age, biological sex, school level attended,

and both parents' education levels. To obtain robust and reliable results (Balboni & Cubelli, 2009; Sun, Pan, & Wang, 2010), we used more than one type of data analysis and considered not only the statistical significance but also the effect size. In this way, we were able to identify the item subsets that both showed statistically significant differences between the children with ADHD or SLD and the matched control group and allowed the classification of participants at above-chance level.

For the ADHD children, some item subsets concern adaptive behaviors strictly connected with the core symptoms of ADHD, i.e., inattention, disorganization, and/or hyperactivity-impulsivity: Controlling impulses, Listening and attending, Understanding, Following instructions, and Playing games. However, the majority of the item subtests discriminating children with ADHD and typically developing controls address different content areas. They were communicating with others (Interactive speech, Speech skills, Expressing complex ideas, Social communication, and Recognizing social cues); developing and maintaining relationships with peers (Expressing and recognizing emotions, Sharing and cooperating, Friendship, Keeping secrets); and being responsible in social context (Appropriate social caution, Responsibility, Restaurant skills, and Money skills).

Consistent with previous investigations (Clark et al., 2002; Crocker et al., 2009; Sparrow et al., 2005; Stein et al., 1995; Sukhodolsky et al., 2005), we found that children with ADHD obtained lower scores in all three Vineland-II domains of Communication, Daily living skills, and Socialization. Moreover, in agreement with the standard diagnostic criteria (American Psychiatric Association, 2013), the analysis of the item subsets we introduced revealed that ADHD affects the adaptive behavior skills encompassing self-control, attention, and organizational capacities. However, the same analysis shows that ADHD also impairs adaptive behavior skills related to understanding in social context and developing interpersonal relationships.

These results are consistent with studies reporting that social impairments are associated with ADHD (e.g., Nijmeijer et al., 2008) and can have a causal role in developing its clinical manifestations (Caillies et al., 2014; Staikova et al., 2013; Uekermann et al., 2010). Usually, *ad hoc* scales are used for psychological problems (e.g., Conners Comprehensive Behavior Rating Scales, Conners, 2008; Childhood Behavior Checklist, Achenbach & Rescorla, 2001), social skills (e.g., Social Skills Improvement System; Gresham & Elliott, 2008), or pragmatics and social cognition (see for example Caillies et al., 2014; Staikova et al., 2013). However, whereas these instruments can detect *symptoms* and defective *knowledge*, the item subsets of the Vineland-II allow the identification of *functional* impairments, thus completing the picture of the consequences of ADHD in *performance* of the functions of daily living.

Our results show that four Vineland-II item subsets, Listening and attending, Expressing complex ideas, Social communication, and Following instructions, constitute the combination that best discriminates between the ADHD and control groups. This combination allowed the discrimination between children with ADHD and peers with typical development with a sensitivity and a specificity of 87.5%, which is very high (Matthey & Petrovski, 2002). The deficits found in the social functioning areas (as revealed by the Expressing complex ideas and the Social communication item subsets) reflect the reduced quality of social, academic, or occupational functioning, which is required by the DSM-5 for the diagnosis of ADHD. These results are in agreement with studies on social deficits associated with ADHD (e.g., de Boo & Prins, 2007; Kofler, Rapport, Bolden, Sarver, Raiker, & Alderson, 2011; Nijmeijer et al., 2008; Staikova et al., 2013).

Additionally, the analysis of the within–ADHD group adaptive behavior profile showed deficits in communication and socialization areas: Receptive and Expressive subdomains were weaker compared with the Written subdomain; the Coping skills

subdomain was defective compared with the Interpersonal relationship and Play and leisure time subdomains. Further, the Community subdomain was more impaired than the Personal subdomain. However, the study of the Vineland-II item subsets allowed a more specific picture of weaknesses and strengths in adaptive behavior of children with ADHD.

Similarly, for children with SLD the evaluation of adaptive behavior results appears to be useful for identifying difficulties in specific activities of daily living. In particular, the Vineland-II item subsets that showed statistically significant differences between children with SLD, all attending primary school, and the matched control group, and allowed classification at above-chance level, were Reading skills, Writing skills, and Times and dates. Moreover, the combination of these item subsets allowed discrimination between children with SLD and control children with a sensitivity of 70.2% and a specificity of 67.7%. Primary school children with SLD showed difficulties connected to the core symptoms of the disorder: reading and understanding materials appropriate to their school level, writing and editing simple correspondence or reports and papers, and putting words in alphabetical order. Consistent with the previous studies (Ditterline et al., 2008; Fagerlund et al., 2012; Leigh, 1987), these children with SLD obtained statistically significantly lower scores than controls on the Vineland-II Communication domain and on the Written subdomain. Moreover, the study of within-SLD group adaptive behavior profile revealed that the Written subdomain was weaker than the Receptive and Expressive subdomains. By means of the item subsets, analysis difficulties in temporal orientation (i.e., saying the current day of the week and telling time on an analog clock) were also found.

On the basis of our results, it appears that children with SLD have learned to cope with the deficits in reading and in writing. Areas of daily living skills, like Money, Computer, or Restaurant skills, which also require reading and writing skills, emerged unimpaired. It follows that, as there is not a direct relationship between impairment severity and

corresponding disability (e.g., Balboni & Ceccarani, 2003), the Vineland-II appears to be a useful tool to evaluate if and to what extent the SLD disorder affects everyday living skills, and whether children with SLD are able to overcome their impairments.

Vineland-II allows measurement of the performance, but not the competence, of an individual. Responses to the instrument are compiled by interviewing a respondent who is familiar with the everyday behavior of the evaluated individual. The third-person interview, however, presents some limitations. First, evaluation is based on the respondent's knowledge, which is inherently limited. Second, any answer tends to reflect the respondents' biases (e.g., parents of children with a developmental disorder may over-represent clinical symptoms in their children). Finally, the clinical diagnosis, if known by the respondent, prevents the blind evaluation of the adaptive behavior.

The present study is an *a posteriori* investigation of information derived from the database used for the Italian standardization of the Vineland-II. This procedure allows us to obtain results independently of the specific properties of the single clinical centers where the data have been collected. However, we must mention some limitations that are intrinsic to any standardization of psychological tests. First, information about individuals with typical development does not include any clinical assessment. Typically, data on cognitive processes like language and executive functions are not available. Consequently, in the present study, the control and clinical groups were matched on relevant socio-demographic variables but not on cognitive variables. Further, we found that children with ADHD, despite being older (and expected to have higher scores) had significantly lower scores than those with SLD on the Vineland-II domains. These results are clinically relevant. However, given that the ADHD and SLD groups were not matched on all variables we cannot identify the item subsets that distinguish between the two groups. Further investigations should address these limitations.

In the present study, seven participants with ADHD also presented with oppositional defiant disorder. Previous studies have not identified any differences in adaptive behavior between children with ADHD alone and peers with ADHD associated with oppositional defiant disorder (Clark et al., 2002). Nevertheless, a group with ADHD alone might better enhance the understanding of the unique characteristics of these children's adaptive behavior.

Previous studies found that girls with ADHD occasionally present with a profile distinct from that of boys with ADHD (e.g., American Psychiatric Association, 2013). In the present investigation we found that, within the SLD groups, girls were misclassified more often than boys by the best combination of Vineland-II subsets. Therefore, further investigations should study the invariance of the profile between sexes.

Finally, the ADHD analysis included only the data of 48 individuals. Given the low prevalence of the disorder, a relatively small sample is quite common in this kind of investigation. However, we found that each item subset of the combination that best classifies the children into the ADHD or control group had a large Cohen's d effect size, ranging from 0.98 to 1.99. Statistical power of the Student's t-test for matched samples ($n = 24$, two-tailed, alpha $= 0.05$) for the smallest of these effect sizes, i.e., 0.98, is 0.99.

4.1 Conclusions

In this study, we used different types of data analysis to identify the differences in functional impairments in daily living performance between children with ADHD or SLD and matched peers with typical development. Our results clearly demonstrate that performance on certain Vineland-II item content categories can be very useful for deriving a valid picture of abilities and disabilities of children with ADHD or SLD.

Ethical Standards

This study was performed in accordance with the ethical standards laid down in the 2013

version of the Declaration of Helsinki. Informed consent was obtained from parents or other

caregivers, as appropriate.

Conflict of Interest

The authors declare that they have no conflict of interest.

Aknowledgment

References

Achenbach, T. M., & Rescorla, L. A. (2001). *Manual for the ASEBA school-age forms & profiles.* Burlington: University of Vermont, Research Center for Children, Youth, and Families.

American Psychiatric Association (2005). *Diagnostic and statistical manual of mental disorder* (4th ed., text revision). Washington, DC: American Psychiatric Press.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatry Press.

Ashwood, K. L., Tye, C., Azadi, B., Cartwright, S., Asherson, P., & Bolton, P. (2015). Brief report: Adaptive functioning in children with ASD, ADHD and ASD + ADHD. *Journal of Autism and Developmental Disorders, 45,* 2235–2242.

Balboni, G., Belacchi, C., Bonichini, S., & Coscarelli, A. (2016). *Vineland-II, Survey Interview Form. Standardizzazione Italiana* [Vineland-II, Survey Interview Form. Italian standardizzation]. Firenze, Italy: Giunti OS Organizzazioni Speciali.

Balboni, G., & Ceccarani, P. (2003). Individuals with mental retardation and a sensorimotor disorder: Assessment of disability. In T.E. Scruggs & M.A. Mastropieri (Eds.), *Advances in Learning and Behavioral Disabilities, Volume 16: Identification and assessment* (pp. 191-204). Oxford, UK: Elsevier Science Ltd.

Balboni, G., & Cubelli, R. (2009). Convergenza delle evidenze e molteplicità delle ipotesi: La verifica dell'ipotesi nulla nella ricerca psicologica. *Giornale Italiano di Psicologia, 4,* 883-898.

Balboni, G., Pedrabissi, L., Molteni, M., & Villa., S. (2001). Discriminant validity of the Vineland Scales: Score profiles of individuals with mental retardation and a specific disorder. *American Journal on Mental Retardation, 106*, 162-172.

Balboni, G., Tasso, A., Muratori, F., & Cubelli, R. (2016). The Vineland-II in preschool children with Autism Spectrum Disorders: An item content category analysis. *Journal of Autism and Developmental Disorders, 46,* 42-52.

Barkley, R. A., Fischer, M., Smallish, L., & Fletcher, K. (2002). The persistence of attention-deficit/hyperactivity disorder into young adulthood as a function of reporting source and definition of disorder. *Journal of Abnormal Psychology, 111,* 279-89.

Benjamini, Y., & Yekutieli, D. (2001). The control of the false discovery rate in multiple testing under dependency. *Annals of Statistics, 29,* 1165–1188.

de Boo, G. M., & Prins, P. J. M (2007). Social incompetence in children with ADHD: Possible moderators and mediators in social-skills training. *Clinical Psychology Review, 27,* 78-97.

Caillies, S., Bertot, V., Motte, J., Raynaud, C., & Abely, M. (2014) Social cognition in ADHD: Irony understanding and recursive theory of mind. *Research in Developmental Disabilities, 35,* 3191–3198.

Clark, C., Prior, M., & Kinsella, G. (2002). The relationship between executive function abilities, adaptive behavior, and academic achievement in children with externalizing behavior problems. *Journal of Child Psychology and Psychiatry, 43*, 785-796.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Conners, K. C. (2008). *Conners Comprehensive Behavior Rating Scales*. Toronto, ON: Multi-Health System Inc.

Crocker, N., Vaurio, L., Riley, E. P., & Mattson, S. N. (2009). Comparison of adaptive behavior in children with heavy prenatal alcohol exposure or Attention-Deficit/Hyperactivity Disorder. *Alcoholism: Clinical and Experimental Research, 33*, 2015-2023.

Ditterline, J., Banner, D., Oakland, T., & Becton, D. (2008). Adaptive behavior profiles of
students with disabilities. *Journal of Applied School Psychology, 24,* 191-207.

Fagerlund, A., Autti-Ramo, I., Kalland, M., Santtila, P., Hoyme, H. E., Mattson, N. S., et al.,
(2012). Adaptive behaviour in children and adolescents with fetal alcohol spectrum
disorders: A comparison with specific learning disability and typical development.
European Child & Adolescent Psychiatric, 21, 221-231.

Fletcher, J. M., Rice, W. J., & Ray, R. M. (1987). Linear discriminant function analysis in
neuropsychological research: Some uses and abuses. *Cortex, 14,* 564-577.

Gresham, F. M., & Elliott, S. N. (2008). *Social skills improvement system—rating scales.*
Minneapolis, MN: Pearson Assessments.

Heber, R. (1961). *A manual on terminology and classification in mental retardation (rev.
ed.).* Washington, DC: American Association on Mental Deficiency.

Kanne, S. M., Gerber, A. J., Quirmbach, L. M., Sparrow, S. S., Cicchetti, D. V., & Saulnier,
C. A. (2011). The role of adaptive behavior in autism spectrum disorders:
Implications for functional outcome. *Journal of Autism and Developmental Disorders,
41,* 1007-1018.

Katusic, M.Z., Voigt, R.G., Colligan, R.C., Weaver, A.L., Homan, K.J., et al. (2011).
Attention-deficit hyperactivity disorder in children with high intelligence quotient:
Results from a population-based study. *Journal of developmental and behavioral
pediatrics, 32*, 103–109.

Kover, S. T., & Atwood, A. K. (2013). Establishing equivalence: Methodological progress in
group-matching design and analysis. *American Journal on Intellectual and
Developmental Disabilities, 118,* 3-15.

Kofler, M. J., Rapport, M. D., Bolden, J., Sarver, D. E., Raiker, J. S., & Alderson, R. M. (2011). Working memory deficits and social problems in children with ADHD. *Journal of Abnormal Child Psychology, 39,* 805-817.

Leigh, J. (1987). Adaptive behavior of children with learning disabilities. *Journal of Learning Disabilities, 20,* 557-562.

Luckasson, R., Schalock, R. L., Spitalnik, D. M., Spreat, S., Tassè, M., Snell, M. E., et al. (2002). *Mental retardation: Definition, classification, and system of supports* (10th ed.). Washington, DC: American Association on Mental Retardation.

Magnúsdóttir, K., Saemundsen, E., Einarsson, B. L., Magnússon, P., & Njardvik, U. (2016). The impact of attention deficit/hyperactivity disorder on adaptive functioning in children diagnosed late with autism spectrum disorder - A comparative analysis. *Research in Autism Spectrum Disorders, 23,* 28-35.

Matthey, S., & Petrovski, P. (2002). The Children's Depression Inventory: Error in cut off scores for screening purposes. *Psychological assessment,14,* 146.

Morris, S. B., & DeShon, R. P. (2002). Combining effect size estimates in meta-analysis with repeated measures and independent-groups designs. *Psychological Methods, 7*, 105–125.

Nijmeijer, J. S., Minderaa, R. B., Buitelaar, J. K., Mulligan, A., Hartman, C. A., & Hoekstra, P.J. (2008). Attention-deficit/hyperactivity disorder and social dysfunctioning. *Clinical Psychology Review, 28,* 692–708.

Paul, R., Miles, S., Cicchetti, D., Sparrow, S., Klin, A., Volkmar, F., et al. (2004). Adaptive behavior in autism and pervasive developmental disorder-not otherwise specified: Microanalysis of scores on the Vineland Adaptive Behavior Scales. *Journal of Autism and Developmental Disorders, 34,* 223-228.

Raven, J., Raven, J. C., & Court, J. H. (1998). *Manual for Raven's Progressive Matrices and Vocabulary Scales. Section 2: The Coloured Progressive Matrices*. San Antonio, TX: Harcourt Assessment.

Roizen, N. J., Blondis, T. A., Irwin, M., & Stein, M. (1994). Adaptive functioning in children with attention-deficit hyperactivity disorder. *Archives of Pediatric and Adolescent Medicine, 148,* 1137–1142.

Schalock, R. L., Borthwick-Duffy, S. A., Bradley, V. J., Buntinx, W. H. E., Coulter, D. L., Craig, E. M., et al. (2010). *Intellectual disability: Diagnosis, classification, and system of supports* (11th ed.). Washington, DC: American Association on Intellectual and Developmental Disabilities.

Sparrow, S. S., Balla, D. A., & Cicchetti, D. V. (1984). *Vineland Adaptive Behavior Scales.* Circle Pines, MN: American Guidance Service.

Sparrow, S. S., Cicchetti, D. V., & Balla, D. A. (2005). *Vineland Adaptive Behavior Scales, second edition.* Circle Pines, MN: American Guidance Service.

Sparrow, S. S., Cicchetti, D. V., & Saulnier, C. A. (2016). *Vineland Adaptive Behavior Scales, third edition.* Minneapolis, MN: Pearson Education.

Staikova, E., Gomes, H., Tartter, V., McCabe, A., & Halperin, J. M. (2013). Pragmatic deficits and social impairment in children with ADHD. *Journal of Child Psychology and Psychiatry, 54,* 1275–1283

Stein, M. A., Szumowski, E., Blondis, T. A., & Roizen, N. J. (1995). Adaptive skills dysfunction in ADD and ADHD children. *Journal of Child Psychology and Psychiatry, 36,* 663–670.

Steiner, P. M., Cook, T. D., Shadish, W. R., & Clark, M. H. (2010). The importance of covariate selection in controlling for selection bias in observational studies. *Psychological Methods, 15*, 250-267.

Sun, S., Pan, W., & Wang, L. L. (2010). A comprehensive review of effect size reporting and interpreting practices in academic journals in education and psychology. *Journal of Educational Psychology, 102,* 989-1004.

Sukhodolsky, D. G., Rosario-Campos, M. C., Scahill, L., Katsovich, L., Pauls, D. L., Peterson, B. S., et al. (2005) Adaptive, emotional and family functioning in children with Obsessive-Compulsive Disorder with and without Attention-Deficit/Hyperactivity Disorder. *The American Journal of Psychiatry, 162,* 1125-1132.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics* (6th ed.). New York, NY: Harper Collins.

Tassé, M. J., Schalock, R. L., Balboni, G., Bersani, H. Jr., Borthwick-Duffy, S. A., Spreat, S., et al. (2012). The construct of adaptive behavior: Its conceptualization, measurement, and use in the field of intellectual disability. *American Journal on Intellectual and Developmental Disabilities, 117,* 291-303.

Uekermann, J., Kraemer, M., Abdel-Hamid, M., Schimmelmann, B. G., Hebebrand, J., Daum, I., et al. (2010). Social cognition in attention-deficit hyperactivity disorder (ADHD). *Neuroscience and Biobehavioral Reviews, 34,* 734–743.

Wechsler, D. (1991). *Manual for the Wechsler Intelligence Scale for Children, Third Edition.* San Antonio, TX : Psychological Corporation.

Wechsler, D. (2003). *Wechsler Intelligence Scale for Children—4th Edition (WISC-IV®).* San Antonio, TX: Harcourt Assessment.

Table 1

Characteristics of the Two Clinical-Control Group Pairs with ADHD or with SLD and with

Typical Development

	ADHD	Controls	SLD	Controls
	(*n* = 24)	(*n* = 24)	(*n* = 61)	(*n* = 61)
Age (yrs)				
M (*SD*)	9.98 (2.64)	9.91 (2.59)	9.14 (1.21)	9.12 (1.18)
Range	5.19 – 14.41	5.19 – 14.51	6.22 – 10.99	6.22 – 10.98
Sex (*n*)				
M – F	20 – 4	20 – 4	37 – 24	37 – 24
School level attended (*n*)				
Kindergarten	1	1	0	0
Elementary	14	14	61	61
Middle	8	8	0	0
High school	1	1	0	0
School year attended (yrs)				
Median	3	3	4	3
Range	0 – 9	0 – 9	1 – 5	1 – 5
Educational level				
Mother				
Certificate (*n*)				
Middle school	6	6	20	20
High	13	12	30	30
University degree or higher	5	6	10	10
Missing	0	0	1	1

School year attended (yrs)				
Median	13	13	13	3
Range	8 – 18	8 – 18	8 – 18	8 – 18
Father				
Certificate (*n*)				
Middle school	7	6	16	16
High	11	12	35	35
University degree or higher	5	5	8	8
Missing	1	1	2	2
School year attended (yrs)				
Median	13	13	13	13
Range	8 – 24	8 – 24	5 – 19	8 – 18

Note. According to criteria proposed by Kover and Atwood (2013) for establishing equivalence in group-matching designs with participants with developmental disabilities, the matched pairs did not differ on age (ADHD: $t[23] = 0.89$, $p = 0.382$, Cohen's $d = 0.18$, $SD^2_{ADHD}/SD^2_{CONTROL} = 1.04$; SLD: $t[60] = 0.55$, $p = 0.586$, Cohen's $d = 0.07$, $SD^2_{ADHD}/SD^2_{CONTROL} = 1.05$). Children with ADHD and controls did not differ on parents' educational level ($\chi^2[2] = 0.13$, $p = 0.937$, Cohen's $w = 0.05$; $\chi^2[2] = 0.12$, $p = 0.989$, Cohen's $w = 0.05$, respectively, for mother's and father's educational level[1]).

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[1]Cohen's w (Cohen, 1988) was evaluated as negligible (< 0.10), small ($0.10–0.29$), medium ($0.30–0.49$), or large (≥ 0.50).

Table 2

Comparison between ADHD and SLD Groups with Their Control Groups on Normative Scores on the Vineland-II Domains, Subdomains and

Adaptive Behavior Composite: Mean (SD) and Student's t-test (Cohen's d)

	ADHD	Controls	Student's *t*-test	SLD	Controls	Student's *t*-test
	M (*SD*)	*M* (*SD*)	(Cohen's *d*)	*M* (*SD*)	*M* (*SD*)	(Cohen's *d*)
Comunication	69.87 (14.75)	95.25 (13.23)	6.38*** (1.27)	88.57 (16.07)	102.92 (13.77)	5.26*** (0.67)
Receptive	9.04 (2.66)	14.29 (2.39)	8.98*** (1.80)	13.00 (2.85)	14.46 (2.58)	3.15** (0.40)
Expressive	10.08 (2.00)	14.46 (2.41)	5.96*** (1.19)	14.18 (3.04)	15.41 (2.60)	2.21
Written	13.08 (3.41)	14.04 (2.39)	1.14	12.51 (2.93)	15.66 (2.81)	6.12*** (0.78)
Daily living skills	84.96 (13.21)	95.17 (12.43)	2.91* (0.58)	101.80 (18.83)	103.98 (12.74)	0.79
Personal	13.58 (2.38)	13.79 (1.77)	0.36	14.98 (2.88)	14.85 (2.59)	0.29
Domestic	13.04 (1.88)	14.50 (2.21)	2.33* (0.47)	15.28 (3.40)	15.41 (3.03)	0.23
Community	11.42 (3.76)	14.54 (3.05)	3.49** (0.70)	15.02 (4.37)	16.28 (3.27)	1.90
Socialization	76.67 (14.72)	98.08 (11.52)	5.75*** (1.15)	98.69 (15.40)	103.47 (12.08)	2.01
Interpersonal relationships	10.87 (2.45)	14.54 (2.04)	6.40*** (1.28)	14.05 (3.39)	14.97 (2.37)	1.74

Play and leisure time	11.58 (3.11)	14.46 (2.26)	3.66** (0.73)	14.15 (3.19)	14.64 (1.96)	1.18
Coping skills	9.62 (2.92)	14.12 (3.93)	4.79*** (0.96)	14.39 (3.87)	15.44 (3.59)	1.65
Adaptive Behavior Composite	73.87 (14.64)	95.58 (11.78)	6.04*** (1.21)	95.84 (16.14)	104.49 (12.19)	3.56** (0.45)

Note. Normative scores on domains and on the Adaptive Behavior Composite are scale scores ($M = 100$, $SD = 15$); on subdomains they are v-scale scores ($M = 15$, $SD = 3$). p value was computed according to the False Discovery Rate procedure (Benjamini & Yekutieli, 2001).

*$p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3

Sets of Vineland-II Items with a Statistically Significant Capacity to Discriminate the ADHD and Control Groups: Differences (Student's t-test),

Probability of Correct Classification (ROC Analysis), Percentage Correctly Classified (Logistic Regression), with Corresponding Effect Sizes, and

Total Capacity for Classification

	ADHD M (SD)	Control M (SD)	Student's t-test (Cohen's d)	Correct classification probability (SE)	Correct classification percentage (Nagelkerke's R^2)	Total capacity classification in percentage
Communication						
Receptive						
Understanding	1.85 (0.10)	1.95 (0.08)	4.24*** (0.82)	.77 (.07)	73 (.31)	75.0
Listening and attending	1.01 (0.40)	1.75 (0.28)	9.89*** (1.99)	.92 (.04)	83 (.65)	87.5
Following instructions	1.41 (0.42)	1.87 (0.28)	4.91*** (0.98)	.84 (.06)	75 (.42)	79.5
Expressive						
Interactive speech	1.57 (0.38)	1.92 (0.15)	4.27** (0.86)	.87 (.05)	81 (.47)	84.0
Speech skills	1.68 (0.41)	1.95 (0.10)	3.35** (0.69)	.88 (.05)	77 (.47)	82.5
Expressing complex ideas	0.75 (0.39)	1.57 (0.43)	7.28*** (1.46)	.91 (.04)	81 (.63)	86.0

Daily living skills

Community

Telephone skills	1.79 (0.34)	1.94 (0.17)	2.60* (0.52)	---	---	---
Money skills	0.88 (0.32)	1.07 (0.32)	3.65** (0.75)	.67 (.08)	65 (.12)	66.0
Rules, rights and safety	1.41 (0.32)	1.58 (0.40)	2.81* (0.55)	---	---	---
Computer skills	1.19 (0.48)	1.50 (0.51)	2.61* (0.51)	---	---	---
Restaurant skills	0.87 (0.90)	1.46 (0.83)	2.70* (0.54)	.67 (.08)	67 (.14)	67.0

Socialization

Interpersonal relationships

Expressing and recognizing emotions	1.86 (0.14)	1.97 (0.10)	4.15** (0.83)	.76 (.07)	77 (.25)	76.5
Social communication	1.00 (0.45)	1.55 (0.38)	7.33*** (1.50)	.81 (.06)	75 (.40)	78.0
Friendship	1.47 (0.39)	1.75 (0.30)	3.14* (0.62)	.70 (.08)	73 (.19)	71.5

Play and leisure time

Sharing and cooperating	1.51 (0.49)	1.91 (0.14)	4.25** (0.85)	.74 (.07)	69 (.34)	71.5
Playing games	1.30 (0.46)	1.69 (0.37)	4.00** (0.81)	.75 (.07)	67 (.24)	71.0

Recognizing social cues	1.00 (0.88)	1.75 (0.53)	3.89** (0.78)	.73 (.07)	71 (.28)	72.0
Coping skills						
Manners	1.46 (0.46)	1.71 (0.45)	2.83* (0.57)	---	---	---
Controlling impulses	0.53 (0.50)	1.21 (0.64)	4.68*** (0.94)	.80 (.06)	73 (.34)	76.5
Keeping secrets	0.48 (0.54)	1.12 (0.77)	3.76** (0.76)	.74 (.07)	73 (.25)	73.5
Responsibility	0.32 (0.51)	0.87 (0.77)	3.16* (0.64)	.69 (.08)	67 (.21)	68.0
Appropriate social caution	0.37 (0.54)	0.89 (0.87)	3.66** (0.77)	.67 (.08)	60 (.15)	63.5

Note. p value was computed according to the False Discovery Rate procedure (Benjamini & Yekutieli, 2001).

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 4

Comparison of Normative Scores on the Vineland-II Domains and Subdomains within ADHD and SLD Groups: Repeated Measures MANOVA

and ANOVA with Corresponding Effect Sizes and Bonferroni's Post-hoc Comparisons (Cohen's d)

	MANOVA		ANOVA	
	Wilk's λ	F^a (η^2)	F^b (η^2_p)	Post-hoc (Cohen's d)
ADHD				
Domains	.289	27.00*** (.71)	23.76*** (.16)	C < AVQ*** (1.54), S** (0.64); S < AVQ** (0.71)
Communication subdomains	.391	17.16*** (.61)	25.59*** (.29)	R < W*** (1.24); E < W*** (1.09)
Daily Living Skills subdomains	.512	10.46*** (.49)	42.37** (.10)	CO < P*** (1.02)
Socialization subdomains	.414	15.59*** (.59)	14.13*** (.08)	CS < IR* (0.64), PLT*** (1.17)
SLD				
Domains	.578	21.55*** (.42)	24.89*** (.10)	C < AVQ*** (0.81), S*** (0.69)
Communication subdomains	.775	8.56*** (.22)	8.68*** (.05)	R < E* (0.36); W < E*** (0.53)

Note. Mean (*SD)* of the normative scores obtained by the ADHD and SLD groups are reported in Table 2. C = Communication; DLS = Daily living skills; S = Socialization; R = Receptive; Expressive = E; Written = W; Personal = P; Domestic = D; CO = Community; IR = Interpersonal relationships; PLT = Play and leisure time; CS = Coping skills.

[a]Degrees of freedom: 2, 22 for ADHD group and 2, 59 for SLD group. [b]Degrees of freedom: 2, 46 (1.44, 33.125 for Daily living skills subdomains comparison) for ADHD group and 2, 120 for SLD group.

p < .05. **p* < .01. ***p* < .001.

Table 5

Sets of Vineland-II Items with a Statistically Significant Capacity to Discriminate the SLD and Control Groups: Differences (Student's t-test),

Probability of Correct Classification (ROC Analysis), Percentage Correctly Classified (Logistic Regression), with Corresponding Effect Sizes, and

Total Capacity for Classification

	SLD M (SD)	Controls M (SD)	Student's t-test (Cohen's d)	Correct classification probability (SE)	Correct classification percentage (Nagelkerke's R^2)	Total capacity classification in percentage
Communication						
Receptive						
Listening and attending	1.55 (0.38)	1.75 (0.34)	3.07* (0.39)	.67 (.05)	63 (.09)	65.0
Expressive						
Speech skills	1.88 (0.17)	1.96 (0.10)	3.20* (0.40)	.64 (.05)	61 (.11)	62.5
Written						
Reading skills	0.70 (0.40)	0.99 (0.35)	5.95*** (0.76)	.71 (.05)	66 (.17)	68.5
Writing skills	1.24 (0.28)	1.47 (0.26)	5.52*** (0.71)	.73 (.05)	66 (.20)	69.5
Daily living skills						

Community

Time and dates	1.50 (0.55)	1.78 (0.41)	4.36*** (0.57)	.69 (.05)	60 (.10)	64.5

Socialization

Play and leisure time

Playing games	1.54 (0.47)	1.79 (0.23)	3.87** (0.49)	.65 (.05)	65 (.14)	65.0

Coping Skills

Controlling impulses	1.08 (0.53)	1.35 (0.46)	3.15* (0.41)	.65 (.05)	61 (.10)	63.0

Note. p value was computed according to the False Discovery Rate procedure (Benjamini & Yekutieli, 2001).

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.