Learning Disabilities: A Contemporary Journal 13(2), 157-175, 2015

How Do Students With Attention-Deficit/ Hyperactivity Disorders and Writing Learning Disabilities Differ From Their Nonlabeled Peers in the Ability to Compose Texts?

Celestino Rodríguez*
University of Oviedo, Spain

Matthias Grünke
University of Cologne, Germany

Paloma González-Castro
Trinidad García
David Álvarez-García
University of Oviedo, Spain

This comparative study investigated the productivity and the process of written composition in students with and without disabilities between 8 and 16 years of age. Participants were assigned to four groups as follows: (a) 59 with both attention-deficit/hyperactivity disorders (ADHD) and writing learning disabilities (WLD), (b) 40 with ADHD, (c) 115 with WLD, and (d) 124 normal achievers (control group). Students' writing productivity was assessed by means of a compare-and-contrast essay task and a writing log that registered the processes involved in composition writing using seven categories. The findings render insight into the way children and youth with ADHD and WLD produce text and how much time they dedicate to the various writing subtasks. Among other things, students with ADHD and WLD spend much less time than normal peers thinking about a written composition or reviewing it, which negatively affects the level of coherence and quality of their texts. A critical discussion of the findings and their psychoeducational implications is included.

Keywords: ADHD, learning disabilities, writing problems, compare-and-contrast essays

Introduction

The Importance of Being Able to Articulate One's Ideas in Writing and What It Involves

The ability to express one's thoughts and opinions in an organized way and in written form is one of the essential skills that children and youth are taught in school. In modern society, written composition is a fundamental mode of communication that is fostered during language instruction. It is a way to express one's content knowledge, intellectual flexibility, and maturity. In many instances, evaluation of students' performance in school subjects not only depends upon their expert knowledge or reasoning skills, but also heavily upon their ability to put their ideas on paper (Diercks-Gransee, Weissenburger, Johnson, & Christensen, 2008; Kellogg & Raulerson, 2007).

*Please send correspondence to: Celestino Rodríguez, University of Oviedo, Department of Psychology, Plaza Feijoo s/n, 33003 Oviedo (Spain), Email: rodriguezcelestino@uniovi.es.

As a result, deficits in this area can have serious consequences for several other areas of learning. In some severe cases, children develop specific written learning disabilities (WLD), sometimes also referred to as written language disorders, written language disabilities, or dysgraphia. While characterizations of WLD vary, common to all definitions are delays (usually approx. two years) in the ability to compose a written composition along with an average intelligence quotient (IQ) and average academic skills in nonwriting-related areas (e.g., math) (Yoshimasu et al., 2011).

To address writing difficulties, or even WLD, it is essential to gather as much information as possible about the characteristics of students who are most at risk for developing problems of this nature. To date, most published studies on learning difficulties focus on reading, spelling, or mathematics, whereas problems in the area of expressive writing are grossly under-researched (Grigorenko, Mambrino, & Preiss, 2012; Grünke & Leonard-Zabel, in press). This is particularly disturbing as large school-based epidemiologic studies have shown that the prevalence of children with severe difficulties in written composition is greater than the prevalence of children demonstrating deficits in reading or mathematics (e.g., Mayes & Calhoun, 2006).

The lack of research on this topic may be associated with the fact that expressive writing is an extremely complex process and the indications of this competency are more difficult to assess than signs of reading fluency, spelling, or arithmetic skills (Rezaei & Lovorn, 2010). However, a number of well-respected theoretical models have been developed to explain the processes by which someone produces a written composition from a cognitive, communicational, or social perspective (e.g., Alamargot & Chanquoy, 2001; MacArthur, Graham, & Fitzgerald, 2006). Despite their diversity, all these frameworks set out to explain the architecture of the skill of expressive writing, its components, and its organization as a recursive process. In addition, they focus on identifying aspects that are modifiable (e.g., writing-related motivation, attitudes, cognitive processes, or metacognitive processes) and, therefore, can be helpful in developing effective intervention approaches.

Briefly, writing requires a person to consider the purpose, the potential readership, the rhetorical elements, the outline, the complexity, and the coherence of a written composition. This intricate process also entails having a lot of information in long-term memory and keeping it in mind while at the same time planning, creating, and reviewing one's ideas (Alamargot & Chanquoy, 2001; Torrance & Galbraith, 2006).

Many diverse models of writing reflect the fact that performing this complex integrated skill is a cognitive task that requires the coordinated deployment of a relevant set of mental processes in a simultaneous and recursive manner (e. g. Berninger, Fuller, & Whitaker, 1996; Hayes, 2012). It is not only necessary to produce ideas, but also to organize them in line with the objectives of a given assignment. Producing ideas is the first step of the planning phase of writing, which includes the generation of ideas, the organization of the produced material, and goal setting (Marzban & Norouzi, 2012). Such complexity demands the involvement of multiple cognitive resources, including the control of attention and self-regulation. It also requires the use of specific writing skills and strategies related to the deployment and organization of the cognitive processes involved in producing a written composition (O'Shanahan, Linda, Jiménez, & Silvia, 2010; Rodríguez et al., 2009).

Students With ADHD as a High-Risk Group for Developing Writing Difficulties

One group of boys and girls that appears to be especially at risk for developing persistent and severe problems in written composition is the population of students with ADHD (Mayes & Calhoun, 2006). Indeed, epidemiological studies have shown that between 3 and 10% of all school-age children and youth demonstrate noticable inattentive and hyperactive behavior (e.g., Frazier, Youngstrom, Glutting, & Watkins, 2007; Jakobson & Kikas, 2007; Polanczyk, Willcutt, Salum, Kieling, & Rohde, 2014).

A major reason for the close link between serious problems in writing composition and ADHD is assumed to the important role that working memory plays in the process of producing text (Adams, Simmons, & Willis, 2015; Kellogg, Olive, & Piolat, 2007). Producing text places a high demand on both the attention system and working memory (De Bono et al., 2012). Because writing composition is generally more complex than reading or calculating, and because it imposes a relatively high cognitive load on working memory, children with ADHD are more prone to fail at writing tasks than reading or math (Mayes, Calhoun, & Crowell, 2000).

Thus, not surprisingly, Re, Pedron, and Cornoldi (2007) found that children with ADHS scored lower on adequacy, structure, grammar, and lexicon in written composition than typically achieving, age-matched peers. Additional studies have revealed that students with ADHD commit a relatively high number of syntactic and coherence errors. For example, they use simple structures and a very basic vocabulary (García, Rodríguez, Pacheco, & Diez, 2009). Further, they tend to devote little time to planning and supervising (i.e., processes of writing that are very fixed and basic), which has a negative impact on the final result and can lead to the production of short stories in which some of the most fundamental components are omitted. Re et al. (2007) suggested that children with ADHD usually experience difficulties producing a written composition because they try to integrate ideas at the planning stage. In addition, they make spelling errors because they attempt to simultaneously reflect on their spelling and consider their ideas. This, in turn, can overload both their attention system and their working memory capacity.

Despite evidence of a link between ADHD and writing difficulties, some researchers have argued that the findings are not conclusive and that such a link is overestimated (De La Paz, 2001; Mayers & Calhoun, 2006; Re et al., 2007). For example, Re and Cornoldi (2010) claimed that the comorbidity is not as close as some authors assume. Further, according to Lange et al. (2007), the partially inconsistent outcomes and the different interpretations of findings are associated with shortcomings of previous studies (e.g., absence of a sophisticated analysis of comprehensive writing productivity, structure, coherence, and quality). In some studies, written composition was measured simply by analyzing the production of single words and single sentences – an approach that Mayes, Calhoun, and Lane (2005) considered insufficient for gaining an accurate assessment of a student's writing skills.

In summary, more research is needed to be able to frame sound and evidence-based conclusions about the connections between ADHD and problems in expressive writing. Specifically, we need to know much more about the characteristics of students with ADHD in situations where they attempt to produce a written composition. In order to identify which children with ADHD need the most help and support to become more proficient writers, it is critical to determine what distin-

guishes a poor writer with ADHD from one with a diagnosed WLD vs. a student with only ADHD and one with only an isolated WLD, or one without any special needs.

Purpose of the Present Study

In the present study, we investigated how writing productivity and the process of written composition is affected by ADHD and WLD. Using quantitative (text-based) and qualitative (reader-based) measures, differences in the ways children and youth in grades three to seven attempt to produce written composition were analyzed in the following preassigned subgroups: (a) ADHD and WLD, (b) ADHD (but without WLD), (c) WLD (but without ADHD), and (d) no special needs or difficulties (control group). Given the lack of data on comorbidity of ADHD and WLD and the specific problems that children and youth with one or both of these diagnoses experience, the following hypotheses were made:

1. When performing a writing task, students with ADHD (with or without an additional WLD) or WLD (with or without an additional ADHD) will be less productive and write fewer paragraphs, sentences, and words than peers without special needs.
2. The writing product of students with ADHD (with or without WLD) or WLD (with or without ADHD) will be less coherent, have less structure, and be of poorer quality than that of their nonlabeled peers.
3. Compared to typically achieving peers, students with ADHD will spend relatively little time on planning, thinking about the content, and revising a written composition. The time they do invest in the task will be disproportionately occupied by the actual writing process. In that way, we expect that they will behave similarly to children and youth with an isolated WLD condition, in that both groups will spend the least time on planning, reviewing, and revising.

Methods and Procedures

Participants

Inclusion criteria. The study was conducted in the Leon region in the northwest of Spain. Our ultimate sample of 338 was recruited through the following procedures: The Department of Psychology at the University of Oviedo maintains close connections with 49 elementary and secondary schools in urban and semi-urban areas. Through the respective principals, we contacted by letter the parents of all students in those schools between grades three and seven who had previously been diagnosed with ADHD and/or WLD. Almost 80% responded positively and gave us written consent to let their children participate in our study.

To substantiate the validity of prior diagnoses for potential participants who were initially classified as having ADHD by a neurologist or a psychiatrist, trained student assistants interviewed parents and teachers using the *Assessment of Attention Deficit With Hyperactivity* (EDAH; Farré & Narbona, 1998) and the *Five to Fifteen Questionnaire* (FIF; Kadesjö et al., 2004). Only students whose medical and psychoeducational findings uniformly suggested that they had ADHD were included in the study. However, the professional classifications and the parent and teacher appraisals

almost always matched. Discrepancies were found in fewer than 5% of all cases, resulting in 99 participants with ADHD.

To be classified as having WLD, students had to meet the following criteria: (a) low performance with a delay of two years in a free essay-writing task, (b) low academic performance in writing, (c) average performance in other nonwriting-related academic areas (based on the academic reports of the respective teachers), and (d) IQ higher than 80 (as determined by a school psychologist).

We administered the *G Factor Test* (Cattell & Cattell, 2001) to all subjects in order to determine their IQ level. The results were normally distributed and similarly dispersed in groups, with a marginally higher IQ in the control group, ANOVA $F(3, 318) = 11.956, \leq .001, \eta^2 = .101$. None of the participants had an IQ lower than 80 or higher than 130 ($M = 102.82$, $SD = 15.59$).

Based on these criteria, 174 students classified as having WLD. About a third of them ($n = 59$) were already part of our ADHD sample because they demonstrated both disorders.

In addition to the students with ADHD and/or WLD, we recruited 124 peers without special needs through bulletins on the participating schools' bulletin boards.

Demographics. Participants' ages ranged from 8 to 16 years old. In accordance with the recruiting process described above, students were assigned to one of the following subgroups: students with ADHD and WLD (ADHD+WLD) ($n = 59$), students with ADHD but without WLD (ADHD) ($n = 40$), students with only WLD ($n = 115$), and students without special needs (control group; $n = 124$).

According to their respective teachers, most participants came from families of medium socioeconomic status, and all children and youth with ADHD and/or WLD were Caucasian. The students in the control group were also predominantly Caucasian, with the exception of 11 Romani and 3 Africans. The educational levels of the subjects' families were mainly in the lower categories. More detailed information concerning the groups comprising the sample is displayed in Table 1.

Table 1. ***Number of Children Participating by Typology and Gender***

	Typology				Total
	ADHD+WLD	ADHD	WLD	Control	
Male	50	30	63	73	216
Female	9	10	52	51	123
Total	59	40	115	124	339
Mean age	11.13	11.37	11.36	10.89	
Mean IQ	100.17	100.41	97.67	109.59	
(*SD*)	(13.11)	(17.16)	(16.19)	(13.37)	

Instruments

Quantitative assessment tool for text-based measures. Students were asked to write a so-called compare-and-contrast essay. That is, a written composi-

tion on the similarities and differences between two activities or games (e.g., soccer vs. basketball, board games vs. video games). Students were allowed to pick a topic of their choice out of a pool of subjects. There was no time limit for the assignment.

The written compositions produced by the subjects were first analyzed quantitatively or text-based in terms of (a) productivity, (b) coherence, and (c) structure. The products were analyzed by two trained raters who were blind to group membership. Both of them were PhD candidates of psychology with extensive experience in writing research. One was female (30 years old); the other was male (27 years old).

To determine *productivity*, the raters counted the number of paragraphs, the number of sentences, the number of verbs, and the total number of words in an essay. The mean inter-rater correlation (Pearson's *r*) across the three categories was .99.

To assess *coherence* from a quantitative perspective, the raters looked at seven linguistic indicators of referential or relational coherence (Sanders, Spooren, & Norman, 2001). *Referential coherence* involves either anaphoric reference ("Peter is a young man. He likes to play football.") or direct repetition of lexical items ("Peter is a young man. Peter likes to play football."). *Relational coherence* includes five types of linguistic indicators based on a classification by Bosque and Demonte (1999): meta-structural, structural, connective, reformulation, and argumentation ties.

Scores for the coherence measures were based on counts of the following linguistic markers: referential coherence (anaphoric and lexical ties), relational coherence (meta-structural, structural, connective, reformulation, argumentation ties), and total coherence (referential and relational coherence).

Meta-structural ties are marked by phrases that explicitly signal the text that follows (e.g., "*Now* I will describe ...," or "The *following* paragraph talks about …"). Structural ties involve markers that indicate sequencing in the text (e.g., "*First*, …", "*Second*, …"). Connective ties are marked by the words *and*, *also*, *as well as*, and so forth. Reformulation ties involve summarization or reiteration of a point in a different form and are marked by phrases such as *in conclusion*, *that is to say*, or *in other words.* Finally, argumentation ties relate to the use of evidence and other means of persuading the reader (e.g., marked by *for example*, *however*, *despite*).

The number of coherence ties within a text depends in part on the length of the text. Instead of presenting simple counts of coherence ties, we report tie density (Total Density Coherence), defined as the number of ties per 100 words in a text. The mean inter-rater correlation (Pearson's *r*) was .98 for referential coherence and .95 for relational coherence.

To evaluate *structure*, essays were rated on whether they contained an introduction, a main body, and a conclusion. Agreement between the raters reached 100%. An overview of the various elements of the counting method is presented in Table 2.

Table 2. ***Aspects of Quantitative (Text-Based) Writing Products Assessed***

Assessed aspect	Parameters
Productivity	Number of paragraphs Number of sentences Number of verbs Total number of words
Coherence	Referential coherence: anaphoric and lexical ties Relational coherence: meta-structural, structural, connectives, reformulation, and argumentation ties Total coherence: referential and relational coherence Total density coherence: number of ties per 100 words
Structure	Number of main parts of text: introduction, main body and conclusion

Qualitative assessment tool for reader-based measures. In a subsequent step, the written compositions were analyzed qualitatively (or from a reader-based perspective). The two raters scored the texts based on structure, coherence, and quality. These three constructs were measured in two different ways: (a) *Order*, on a scale with numeric categories from 1 to 4 or 1 to 6; and (b) *Adding*, or the sum of the diverse criteria value (previously assigned) in each measure. This scheme has been used in a number of previous studies (e.g., García & Fidalgo, 2008; Torrance, Fidalgo, & García, 2007). Variables included Adding-Structure, Adding-Coherence, Adding-Quality, Order-Structure, Order-Coherence, and Order-Quality. An evaluation sheet (available from the first author) that was slightly modified from the original scheme by Spencer and Fitzgerald (1993) was used. The two independent raters were blind to group membership. In the rare case of a discrepancy between ratings, disagreements were resolved by averaging the scores.

Structure was assessed on a four-point scale ranging from 1 = unstructured to 4 = well structured. Assessments were based on the extent to which the two raters thought that the text included (a) background information introducing the text, (b) cues indicating text structure, (c) an introductory topic or thesis sentence, (d) clear organization of ideas around a definite scheme, (e) unity of theme within paragraphs and across the entire essay, and (f) a conclusion that reiterated the purpose of the paper. The independent categorizations yielded a mean agreement of kappa = .95.

Coherence was also assessed on a four-point scale ranging from 1 = incoherent to 4 = very coherent, with assessments based on the extent to which raters perceived that (a) a topic or theme was identified and remained a focus during the essay, (b) the text included a context to guide the reader, (c) the information was organized in a discernible pattern throughout the text, (d) sentences and paragraphs were cohesively connected, and (e) the discourse flowed smoothly. Comparison of the independent raters' categorizations yielded a mean agreement of kappa = .94.

Quality was assessed on a six-point scale ranging from 1 = difficult to understand to 6 = excellent, with assessments based on the extent to which the text

demonstrated (a) a clear sequence of ideas, with little or no irrelevant detail; (b) clear organization; (c) fresh and vigorous word choice; (e) varied and interesting details; (f) correct sentence structure; and (g) accurate punctuation, capitalization, and spelling. Comparison of the independent raters' categorization yielded a mean agreement of kappa = .92.

Writing log (writing processes assessment). Participants were asked to write a second compare-and-contrast essay. While attending to that task, students had to report their activities in a so-called writing log (Olive, Kellogg, & Piolat, 2002; Torrance et al., 2007) – a table in which participants document the process by which they arrive at the final result of their composition endeavors.

In our study, students heard a 1-second tone played at random intervals of 30 to 90 seconds, with a mean interval of 45 seconds, while attending to their writing task. As soon as they noticed the signal, they had to quickly check the appropriate box on a simple and clearly arranged writing log (available from the first author) that represented the activity in which they were occupied at the time. According to García and Fidalgo (2006), such a procedure does not have a noticeable disruptive effect on the writing process.

The writing log consisted of seven categories, as follows: (a) *Reading references* (reading information and data about the topic), (b) *thinking about content* (thinking about things to say in the essay), (c) *writing outline* (making a plan/outline or notes about the essay to be written), (d) *writing text* (writing the essay), (e) *reading text* (reading through parts or all of the text), (f) *changing text* (making changes in the writing like correcting spelling mistakes, changing words, or adding words), and (g) *unrelated* (doing or thinking about something unrelated to the text like talking to a classmate, looking for a pen, gazing out of the window). Thus, taking into consideration the time between records, it was possible to obtain an approximation of measurements or variables, frequency (number of records in each category), time percentage in each category, and time in seconds in each category.

Before doing the second compare-and-contrast essay-writing task, students were trained in how to use the writing log. They were first presented with the names and definitions of the seven categories used in the self-report task to ensure that they knew the mechanics of the log-recording processes. The participants were reminded of the seven action definitions and encouraged to report only the activity that they were involved in at the time the signal went off.

After the initial training, students' accuracy of filling out the writing log was evaluated using the example of a writer thinking aloud while planning and drafting a text and asking the students to note the writer's activity at each of 25 different points. The students' categorizations by group means were subsequently compared with those of one of our expert raters. In the ADHD group, mean agreement was kappa = .90, in the ADHD+WLD group, mean agreement was kappa = .84, in the WLD group, mean agreement was kappa = .84, and in the control group, mean agreement was kappa = .95.

The data from the writing log task were analyzed by dividing the total time spent by each subject on the task into three equal parts and comparing the activities that they were involved in during the early, middle, and final stages of the writing process.

Procedure

The text- and reader-based assessments were conducted in groups of 15 to 20 students during two sessions of 50 minutes each. Researchers who were experienced in administering writing tests served as the supervisors. All assessments were carried out within a timeframe of three months.

In the first session, participants were asked to perform a compare-and-contrast essay writing task. During the second session, the subjects were asked to write another compare-and-contrast essay writing task, but this time with constant short interruptions prompting them to fill out a time sample self-report (writing log) (Olive et al., 2002; Torrance et al., 2007).

Data Analysis

The data were analyzed using the SPSS 19.0 program (IBM, Chicago, IL). Normal distribution of the productivity measures allowed us to conduct multivariate analysis of covariance with the IQ as a covariate (MANCOVA). Comparisons to check for specific differences among the four groups were carried out, specifically post hoc contrasts (Bonferroni). The data from the writing log task were not normally distributed. Thus, a nonparametric test (Kruskal-Wallis) was used for analysis. As mentioned, the three phases of the writing process were jointly analyzed by dividing the total time spent by each subject on the task into three parts and then comparing all subjects in the early (1st phase), middle (2nd phase), and end (3rd phase) of the writing task.

Results

Product Measures

Written composition was analyzed for length in terms of text- and reader-based assessments (structure, coherence, and quality in order and adding). The MANOVA (typology of the children) yielded a statistically significant result, λ=***.487,*** $F(3, 705)=5.83$, $p \leq .001$, $\eta^2=.214$.

Considerable variation was found in the length of students' compare-and-contrast written compositions. Based on the reader-based measures, the differences were statistically significant for all variables involving writing structure, coherence, and quality. Based on the text-based measures, a large number of variables revealed statistically significant differences, especially in Total Productivity and Total Text Structure. Table 3 summarizes the key findings, group means, and standard deviations.

The Bonferroni post-hoc multiple comparisons showed the following: (a) for text-based measures, only the differences between ADHD+WLD, WLD, and ADHD and the control group were nonsignificant; (b) for reader-based measures (structure, coherence, and quality), statistically significant differences were found for all control group comparisons, as well as between the ADHD+WLD and WLD groups in structure. Multiple comparisons between the ADHD+WLD and ADHD groups were nonsignificant, with the exceptions of structure and quality measures (*adding*), which in each case revealed the additional challenges of the ADHD+WLD group.

Table 3. ***Means and Standard Deviations of Comparative-Contrast Productivity in Multivariate Contrast of Groups***

	ADHD + WLD	ADHD	WLD	Control	$F_{(3, 705)}$	η^2
Text-based measures						
Paragraph count	1.59(1.05)	2.79(1.57)	1.73(.92)	2.39(1.11)	10.835***	.094
Sentence count	2.02(1.15)	3.59(1.87)	2.46(1.80)	3.33(1.62)	8.363***	.074
Verb count	6.31(3.45)	11.26 (6.64)	6.80(4.40)	11.11(4.78)	14.036***	.119
Total productivity	35.80(17.76)	62.15(30.01)	35.98(19.32)	58.03(23.17)	17.252***	.142
Referential coherence	3.15(2.58)	6.41(5.89)	3.28(3.20)	.45(3.26)	14.036***	.072
Relational coherence	2.80(2.39)	4.06(2.30)	2.19(1.72)	3.32(1.73)	8.941***	.079
Total coherence	5.94(3.94)	10.47(7.29)	5.47(4.36)	8.77(4.28)	11.019***	.096
Other aspects						
Total text coherence	1.02(.41)	1.18(.57)	1.04(.19)	1.28(.54)	3.685*	.034
Total text structure	1.07(.88)	1.24(1.01)	1.04(.19)	2.56(.97)	36.449***	.259
Reader-based assessment						
Adding: Structure	.74 (.75)	1.34 (.80)	1.28 (.82)	2.17 (.76)	38.189***	.268
Adding: Coherence	.90 (.69)	1.45 (.82)	1.28 (.82)	2.25 (.85)	41.597***	.285
Adding: Quality	1.22 (.86)	1.91 (.90)	1.50 (.91)	2.50 (.87)	30.907***	.229
Order: Structure	1.41 (.59)	1.88 (.68)	1.72 (.67)	2.44 (.67)	27.699***	.210
Order: Coherence	1.48 (.54)	1.82 (.62)	1.79 (.66)	2.49 (.64)	38.478***	.269
Order: Quality	1.61 (.56)	2.06 (.60)	1.85 (.69)	2.63 (.66)	37.195***	.263

Note. Standard deviations are shown in parenthesis.
η^2 (eta-squared statistic) = estimates of effect size. According to Aron and Aron (1999), the following criteria should be used: .10 = small effect size, .25 =medium effect sizes, and .40 = large effect size.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Table 4. ***Estimated Average Range of the Nonparametric Analysis (Kruskal Wallis) of Various Activities of the Writing Processes***

	Average range				X^2
	ADHD + WLD	ADHD	WLD	Control	
Total processes					
Total time writing processes (sec.)	124.77	178.14	139.98	207.55	42.886***
Total time writing processes, excluding unrelated activities (sec.)	125.29	177.74	139.55	207.83	43.129***
Total time writing (sec.)	125.29	177.74	139.55	207.83	43.129***
Frequency					
Reading references	164.05	163.73	177.98	157.98	8.423*
Thinking about content	147.19	157.19	154.34	190.24	12.916**
Writing outline	169.51	159.26	176.71	157.98	8.047*
Writing text	146.39	183.68	135.34	199.47	30.413***
Reading text	131.20	164.53	167.26	183.66	15.945***
Changing text	150.46	155.43	153.20	190.29	16.027***
Time percentage					
Reading references	164.26	163.35	178.34	157.67	8.971*
Writing outline	169.59	159.30	176.79	157.85	8.173*
Writing text	187.14	185.68	144.41	170.54	10.514*
Reading text	131.65	165.01	172.05	178.84	13.187**
Changing text	156.25	157.16	154.67	185.54	10.020*
Time (seconds)					
Reading references	164.05	163.73	177.98	157.98	8.423*
Thinking about content	147.19	157.19	154.34	190.24	12.916**
Writing outline	169.51	159.26	176.71	157.98	8.047*
Writing text	146.39	183.68	135.34	199.47	30.413***
Reading text	131.20	164.53	167.26	183.66	15.945***
Changing text	150.46	155.43	153.20	190.29	16.027***

Note. X^2 = Kruskal-Wallis. Only statistically significant results ($p \leq .05$) are represented. *$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Process Measures

First, the total process measures of the writing activities were determined. Second, the process measures by phase during the writing activity (1st phase, 2nd phase, and 3rd phase) were described, with the aim of analyzing the writing process in the four groups (WLD, ADHD, ADHD+WLD, and control). Three measures for each of the seven activities were used: (a) frequency, or number of activities marked by the students during the writing task; (b) seconds spent on each of the seven activities (estimated by multiplying the number of times that participants checked a particular activity in their writing log by the mean inter-tone interval of 45 seconds); and (c) time percentage (calculated for each activity).

With the exception of *thinking about content,* the results of nonparametric analyses showed statistically significant differences in practically all the activities measured for time percentage variable. The findings of the nonparametric analysis and the average range are summarized in Table 4 (unrelated activity was not included because it is not a specific writing activity).

The Mann-Whitney U-Test revealed significant differences between pairs of groups using the Bonferroni protection ($p<.05/6 = .008$). These differences are described below.

ADHD+WLD differed from ADHD in total time writing processes ($U = 666.500$, $p \leq .001$), total time writing processes excluding unrelated activities ($U = 610.000$, $p \leq .001$), writing outline ($U = 984.000$, $p \leq .01$) and writing text ($U = 686.000$, $p \leq .001$) in the first phase, and writing outline ($U = 964.000$, $p \leq .001$) in the third phase.

The WLD group differed from the ADHD group only in writing outline ($U = 1783.500$, $p \leq .01$) and writing text ($U = 1430.000$, $p \leq .001$) in the first phase. In contrast, the ADHD+WLD group differed from the control group in total time writing process ($U = 1691.000$, $p \leq .001$) and total time writing ($U = 1662.500$, $p \leq .001$). Statistically significant differences between these groups were also found in *thinking about content* ($U = 2427.000$, $p \leq .001$), writing text ($U = 2181.000$, $p \leq .001$), reading text ($U = 2333.000$, $p \leq .01$), and changing text ($U = 2806.000$, $p \leq .01$) during the fist phase as well as in reading text ($U = 2391.000$, $p \leq .001$) in the second phase.

Finally, the WLD group differed from the control group in time writing process ($U = 4555.500$, $p \leq .001$), total time writing ($U = 4531.00$, $p \leq .001$), as well as reading references ($U = 5573.500$, $p \leq .01$) and writing text ($U = 4628.000$, $p \leq .001$) in the first phase, and reading references ($U = 5546.000$, $p \leq .01$) in the second.

Nonparametric analysis, on the other hand, revealed statistically significant differences in some total activity measures by the three phases (1st, 2nd, and 3rd) during the writing process. The findings of the nonparametric analysis and average range are summarized in Table 5.

Processes at the first measurement point. The control group obtained the highest percentage in planning processes, whereas the two ADHD groups (ADHD+WLD and ADHD) obtained the lowest. In contrast, these three groups (with the exception of the WLD group) obtained high percentages on the editing process. The Mann-Whitney U-Test revealed significant group differences with Bonferroni protection ($p< .05/6 = .008$); ADHD+WLD vs. ADHD in variable writing text (frequency) ($U = 789$, $p \leq .001$); ADHD+WLD vs. control in *thinking about content* (frequency) ($U = 2453.5$; $p \leq .001$); writing text (frequency) ($U = 2396.5$, $p \leq .001$); and WLD vs. control in writing text (frequency) ($U = 4875.5$, $p \leq .01$).

Table 5. ***Estimated Average Range of the Nonparametric Analysis (Kruskal Wallis) of Various Activities of the Writing Process at Three Different Phases (1st, 2nd, 3rd)***

	Average range				X^2
	ADHD + WLD	ADHD	WLD	Control	
Processes: 1st phase					
Frequency					
Reading references	165.52	165.16	174.77	159.77	8.891*
Thinking about content	150.04	143.26	157.34	190.68	14.813**
Writing text	146.03	182.86	138.67	196.83	25.827***
Time percentage					
Reading references	165.49	164.95	174.96	159.67	9.261*
Writing text	179.25	178.28	148.21	173.31	n.s.
Time (seconds)					
Reading references	165.52	165.16	174.77	159.77	8.891*
Thinking about content	150.04	143.26	157.34	190.68	14.813*
Writing text	146.03	182.86	138.67	196.83	25.827***
Processes: 2nd phase					
Frequency					
Writing outline	173.14	157.84	172.75	160.34	n.s.
Writing text	148.69	174.69	138.69	198.22	25.253***
Time percentage					
Writing outline	173.24	157.96	172.70	160.30	n.s.
Time (seconds)					
Writing outline	173.14	157.84	172.75	160.34	n.s.
Writing text	146.03	182.86	138.67	196.83	25.253***
Processes: 3rd phase					
Frequency					
Writing outline	166.89	158.50	173.33	162.63	n.s.
Writing text	163.01	190.11	146.94	178.50	9.282*
Reading text	137.22	166.08	164.50	182.76	14.148**
Changing text	157.40	153.68	157.05	183.93	10.836*
Time percentage					
Writing outline	166.96	158.50	173.31	162.62	n.s.
Writing text	181.70	192.21	152.85	163.22	n.s.
Reading text	137.89	164.46	168.06	179.68	11.735 **
Changing text	159.85	155.85	158.53	180.64	n.s.

	Time (seconds)				
Writing outline	166.89	158.50	173.33	162.63	n.s.
Writing text	163.01	190.11	146.94	178.50	9.282*
Reading text	137.22	166.08	164.50	182.76	14.148**
Changing text	157.40	153.68	157.05	183.93	10.836*

Note. X^2 = Kruskal-Wallis; n.s. = nonsignificant. Only statistically significant ($p < .05$) results and those approaching significance are presented.
*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

Processes at the second measuring point. The most significant change was that the ADHD students were still thinking about the content, which may suggest that slower processing may hinder the formation of clear ideas. The resources of the control group during the reviewing process were significantly superior to those of the other three groups, with post-hoc tests showing group differences in ADHD+WLD vs. ADHD in writing text (frequency) ($U = 714.5$, $p \leq .001$); WLD vs. ADHD in writing text (frequency) ($U = 1536$, $p \leq 0.01$); ADHD+WLD vs. control in writing text (frequency) ($U = 2273.5$, $p \leq .001$); and WLD vs. control in writing text (frequency) ($U = 4778.5$, $p \leq .001$).

Processes at the third measuring point. The two ADHD groups had a higher percentage in writing, yet they barely spent time reviewing the processes, either to read or to change the wording of the text. ADHD+WLD vs. ADHD in writing text (s.) ($U = 809$, $p \leq .01$); WLD vs. ADHD in writing text (s.) ($U = 1542.5$, $p \leq .01$); ADHD vs. control in writing text (time %) ($U = 1706.5$, $p \leq .01$); ADHD+WLD vs. control in reading text (frequency) ($U = 2582.5$, $p \leq .001$) and reading text (time %) ($U = 2630$, $p \leq .001$).

Discussion

Main Findings

The purpose of this study was to identify and to describe the way students with ADHD and/or WLD from grades three to seven perform written composition tasks. Subjects were divided into four subgroups: (a) students with ADHD only, (b) students with ADHD and WLD, (c) students with WLD only, and (d) students with no special educational needs (control group). Our study yielded the following results:

1. ADHD does not affect the writing productivity. Students with ADHD do not write shorter written compositions than their peers and develop as many ideas as their nonlabeled counterparts. However, if they simultaneously demonstrate both ADHD and WLD, they produce comparatively short written compositions. The same applies to students with only WLD.
2. Students with ADHD produce written compositions with less coherence and of poorer quality than peers without ADHD. The most obvious weakness that they seem to display is a lack of clear organization

of ideas evolving around a given theme. If they have both ADHD and WLD, they show an even less coherence and produce written compositions of even lower quality.

3. Students with ADHD spend very little time thinking about the content of the essay they are planning to write. They seldom reflect on a text that they have composed, rarely reread it, and invest very little effort in correcting what they have written. Interesting, however, they try to edit the product of their efforts before finishing it.
4. Students with WLD (with or without ADHD) invest remarkably little time in the process of editing a written composition both while writing it and also after completing it.

Our results thus met most of our initial expectations, even though partially in a different manner than we had predicted, and contrary to the findings of previous research (Da La Paz, 2001; Re & Cornoldi, 2010; Re et al., 2007). Specifically, participants in the sample with ADHD produced written compositions that were not significantly shorter than those of their typically achieving peers. That is, not being able to focus, being overactive, or not being able control their behavior did not suffice as reasons for their somewhat shorter writing products. One possible reason for the apparent discrepancy between these results and some previous findings might be the fact that ADHD often co-occurs with WLD. Many studies make no clear distinction between subjects with only ADHD and those who also have WLD.

Furthermore, we had expected that the major difference between the students with both ADHD and WLD and the control group would lie in the planning of the text. But the most distinctive differences between these two subsamples were manifested in the processes of reviewing and editing a writing product. Unfortunately, however, there is not an overly solid research base to draw upon as the initial research question was framed in this context.

Notwithstanding some unexpected outcomes, the majority of our results fall in line with previous findings. For example, many studies have documented that children and youth with ADHD display severe difficulties in planning and monitoring the writing process (García et al., 2013), lack phonological and orthographic skills (Re et al., 2007), and carry out writing tasks in a relatively inefficient manner (Rodríguez et al., 2011). As such, we were able to shed additional light on the characteristics of students with ADHD and/or WLD as they relate to expressing their ideas in writing.

What is innovative and novel about the present study is its focus on the writing processes instead of only concentrating on the product, as in previous research. By focusing on the way struggling writers achieve a certain end, rather than on just the results of their efforts, insights can be gained that are needed for developing interventions that more precisely meet these students' needs.

Limitations

Despite the promising results, our findings are subject to certain limitations. First, working memory and some other components that are crucial for mastering this competency (see, e.g., McCuthchen, 2011) were factored out. Besides, the procedure for estimating the time spent on each of the seven activities may be viewed as

problematic. That is, frequency of occurrence does not necessarily equate with long duration.

Another limitation pertains to the identification of WLD. In Spain, where this study took place, as in other countries, there is no succinct and concise definition of learning disabilities or WLD (McLaughlin et al., 2006). Thus, some of our conclusions must be viewed with a degree of caution. Furthermore, we limited our study to examining the writing of one specific text genre: compare-and-contrast essays. Thus, we cannot determine how our subgroups differ from each other in terms of their ability to produce other kinds of text. Finally, we used a very heterogeneous sample with regard to age (between 8 and 16 years old). This may be considered problematic, because students perform writing tasks differently at different developmental stages.

Implications

These findings highlight the specific attributes of children and youth with ADHD and/or WLD in terms of the written compositions they produce and the way they perform writing tasks. The insights that emerged from this study should be taken into account when constructing instructional programs.

Specifically, students with ADHD and/or WLD clearly spend much less time on processes such as thinking about a text, reading a text, or correcting a text than their nonlabeled peers, as evidenced in their inferior levels of coherence and in the low quality of their compositions (Torrance et al., 2007). These findings point to the need for interventions that help children and youth with ADHD and/or WLD plan ahead for what they are going to write and, subsequently, to thoughtfully and consistently put their ideas into writing. To that end, previous research indicates that graphic organizers can be of great help as students with ADHD and/or WLD strive to produce meaningful written composition of high quality (Hennes, Büyüknarci, Rietz, & Grünke, 2015; Rodríguez et al., 2011).

A corollary of the study's findings is that IQ and quality of written composition are not closely related, an observation that is supported by Schuck and Crinella (2005), who found that ADHD and intellectual capacities are largely independent from each other. However, even though most students with ADHD and/or WLD possess normal intellectual abilities, just providing them with instructions on how to compose a meaningful text is not sufficient. This study underscores the fact that the writing problems of children and youth with ADHD and/or WLD are both far-reaching and multifaceted. Thus, students need a step-by-step framework to support their writing skills in combination with procedural facilitation. That is, enhancement of both declarative knowledge (knowing what has to be done) and procedural expertise (being able to actually perform the task) has to be addressed, with special attention given to the latter, which is directly related to the executive difficulties of children with ADHD (Re & Cornoldi, 2010).

Directions for Future Research

The findings of the present study point to the importance of the research community in special education paying more attention to students' writing problems, especially those of students with ADHD, who are at high risk of never learning how to compose a meaningful text without proper guidance and support. Thus, it

is necessary to develop a sound psycho-educational model that takes both ADHD and severe writing problems into account (Graham & Harris, 2005; Graham & Perin, 2007).

The incidence of comorbidity between ADHD and WLD is great. The present study documented the severe deficits that the respective children and youth exhibit regarding the coherence and the quality of the written compositions their produce. The challenges that students with ADHD and WLD face are not simply added, but rather, they seem to interact with each other, and this makes it even harder to compose meaningful and significant written compositions. Thus, future research should attempt to shed further light on the writing processes of children and youth with attention and writing problems. Working memory plays a vital role in one's efforts to compose coherent writing. It is, thus, necessary to explore the characteristics of the students with ADHD and WLD in greater detail in order to design effective intervention tools or to improve already existing ones.

Finally, revision processes represent an important area in need of future research to substantiate the development of sound methods for fostering the writing skills of high-risk students. Such methods might also be complemented with additional types of programs. For example, self-regulation techniques such as Self-Regulated Strategy Development (Graham & Harris, 2005) have been sufficiently validated, have well-established implementation procedures, and are well accepted by classroom teachers. Current studies suggest that self-regulation interventions should be considered as a component of multimodal treatment programs aimed at improving writing skills of children with ADHD in the classroom (Reid & Lienemann, 2006). However, it is of vital importance to possess enough information to enable scholars to tailor effective interventions and to adjust them to the specific needs of the actual students that they are supposed to be helping.

References

Adams, A., Simmons, F., & Willis, C. (in press). Exploring relationships between working memory and writing: Individual differences associated with gender. *Learning and Individual Differences.*

Alamargot, D., & Chanquoy, L. (2001). *Through the models of writing.* Dordrecht, The Netherlands: Kluwer Academic Publishers.

Aron, A., & Aron, E. N. (1999). *Statistics for psychology*. Upper Saddle River, NJ: Prentice Hall.

Berninger, V. W., Fuller, F., & Whitaker, D. (1996). A process model of writing development across the life span. *Educational Psychology Review, 8*, 193-218.

Bosque, I., & Demonte, V. (1999). *Gramática descriptive de la lengua española. Vol 3: Entre la oración y el discurso* [Descriptive Grammar of Spanish Language, Vol. 3: Between sentence and discourse]. Madrid, Spain: Espasa Calpe.

Cattell, R. B., & Cattell, A.K.S. (2001). *Factor "g."* Madrid, Spain: TEA Editions.

De Bono, T., Hosseini A., Cairo, C., Ghelani, H., Tannock, R., & Toplak, M. E. (2012). Written expression performance in adolescents with attention-deficit/ hyperactivity disorder (ADHD). *Reading & Writing, 25*, 1403-1426

De la Paz, S. (2001). Teaching writing to students with attention deficit disorders and specific language impairment. *Journal of Educational Research*, *95*, 37-47.

Diercks-Gransee, B., Weissenburger, J. W., Johnson, C. L., & Christensen, P. (2008). Curriculum-based measures of writing for high school students. *Remedial and Special Education, 30*, 360-371.

Farré, A., & Narbona, J. (1998). *Evaluación del trastorno por déficit de atención con hiperactividad.* Madrid, Spain: TEA.

Frazier, T. W., Youngstrom, E. A., Glutting, J. J., & Watkins, M. W. (2007). ADHD and achievement. *Journal of Learning Disabilities, 40*, 49-65.

García, J. N., & Fidalgo, R. (2006). Effects of two types of self-regulatory instruction programs on students with learning disabilities in writing products, processes, and self-efficacy. *Learning Disability Quarterly, 29*, 181-211.

García, J. N., & Fidalgo, R. (2008). The orchestration of writing processes and writing products: A comparison of 6th grade students with and without learning disabilities. *Learning Disabilities. A Contemporary Journal, 6*, 77-98.

García, J. N., Rodríguez, C., Pacheco, D., & Diez, C. (2009). Influence of cognitive effort, sustained attention, working memory and ADHD symptoms in the process and product of written composition. An experimental study. *Estudios de Psicología, 30*, 31-50.

García, T., Rodríguez, C., González-Castro, P., Álvarez, D., Cueli, M., & González-Pienda, J. A. (2013). Executive functioning in children and adolescents with attention deficit hyperactivity disorder and reading disabilities. *International Journal of Psychology and Psychological Therapy, 13*, 179-194.

Graham, S., & Harris, K. R. (2005). Improving the writing performance of young struggling writers. *Journal of Special Education*, *39*, 19-33.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*, 445-476

Grigorenko, E. L., Mambrino, E., & Preiss, D. P. (2012). *Writing: A mosaic of new perspectives.* New York, NY: Psychology Press.

Grünke, M., & Leonard-Zabel, A.-M. (in press). How to support struggling writers: What the research stipulates. *International Journal of Special Education.*

Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication, 29*, 369-388.

Hennes, A.-K., Büyüknarci, Ö., Rietz, C., & Grünke, M. (2015). Helping children with specific learning disabilities to improve their narrative writing competence by teaching them the use of the story maps strategy. *Insights into Learning Disabilities, 12*, 35-56.

Jakobson, A., & Kikas, E. (2007). Attention-deficit/hyperactivity disorder with and without comorbid learning disabilities. *Journal of Learning Disabilities*, *40*, 194-202.

Kadesjö, B., Janols, L. O., Korkman, M., Mickelsson, K., Strand, G., Trillingsgaard, A., & Gilberg, C. (2004). The FTF (Five to Fifteen): The development of a parent questionnaire for the assessment of ADHD and comorbid conditions. *European Child & Adolescent Psychiatry, 13*, 3-13.

Kellogg, R. T., Olive, T., & Piolat, A. (2007). Verbal, visual, and spatial working memory in written language production. *Acta Psychologica, 124*, 382-397.

Kellogg, R. T., & Raulerson, B. A. (2007). Improving the writing skills of college students. *Psychonomic Bulletin & Review, 14,* 237-242.

Lange, K. W., Tucha, L., Walitza, S., Gerlach, M., Linder, M., & Tucha, O. (2007). Interaction of attention and grapho-motor functions in children with attention deficit hyperactivity disorder. *Journal of Neural Transmission, 72* (Suppl. 1), 249-259.

MacArthur, C. A., Graham, S., & Fitzgerald, J. (2006). *Handbook of writing research.* New York, NY: Guilford Press.

Marzban, A., & Norouzi, M. (2012). Strategic planning focus and time in narrative writing. *Procedia – Social and Behavioral Sciences, 46*, 4953-4956.

Mayes, S. D., & Calhoun, S. L. (2006). Frequency of reading, math, and writing disabilities in children with clinical disorders. *Learning and Individual Differences, 16*, 145-157.

Mayes, S. D., Calhoun, S. L., & Crowell, E. W. (2000). Learning disabilities and ADHD: Overlapping spectrum disorders. *Journal of Learning Disabilities*, *33*, 417-424.

Mayes S. D., Calhoun, S. L., & Lane, S. E. (2005). Diagnosing children's writing disabilities: Different tests give different results. *Perceptual and Motor Skills, 101*, 72-78.

McCutchen, D. (2011). From novice to expert: Implications of language skills and writing relevant knowledge for memory during the development of writing skill. *Journal of Writing Research, 3*, 51-68.

McLaughlin, M. J., Dyson, A., Nagle, K., Thurlow, M., Rouse, M., Hardman, R., Norwich, B., Burke, P. J., & Perlin, M. (2006). Cross-cultural perspectives on the classification of children with disabilities. *The Journal of Special Education, 40,* 46-58.

Olive, T., Kellogg R. T., & Piolat A. (2002). The triple task technique for studying the process of writing. In G. Rijlaarsdam, T. Olive, & C. M. Levy (Eds.), *Studies in writing (Vol. 10): Contemporary tools and techniques for studying writing* (pp. 31-59). London, UK: Kluwer Academic Publishers.

O'Shanahan, I., Linda, S., Jiménez, J. E., & Silvia, M. (2010). Analyzing cognitive and spelling skills in Spanish-speaking English-language learners and English-speaking Canadian learners. *European Journal of Education and Psychology, 3*, 45-58.

Polanczyk, G.V., Willcutt, E. G., Salum, G. A., Kieling, C., & Rohde, L. A. (2014).ADHD prevalence estimates across three decades: an updated systematic review and meta-regression analysis. *International Journal of Epidemiology, 43*, 434-442.

Re, A. M., & Cornoldi, C. (2010). ADHD expressive writing difficulties of ADHD children. *European Journal of Psychology of Education, 25*, 315-323.

Re, A. M., Pedron, M., & Cornoldi, C. (2007). Expressive writing difficulties in children described as exhibiting ADHD symptoms. *Journal of Learning Disabilities*, *40*, 244-255.

Reid, R., & Lienemann, T. O. (2006). Self-regulated strategy development for written expression with students with Attention Deficit/Hyperactivity Disorder. *Exceptional Children*, *73*, 53-68.

Rezaei, A. R., & Lovorn, M. (2010). Reliability and validity of rubrics for assessment through writing. *Assessing Writing, 15*, 18-39.

Rodríguez, C., García, J. N., González-Castro, P., Álvarez, D., Álvarez, L., Núñez-Pérez, J. C., González-Pienda, J. A., Gázquez, J., & Bernardo, A. (2009). El proceso de revisión escrita en alumnos con Trastorno por Déficit de Atención e Hiperactividad y Dificultades de Aprendizaje. *Revista de Psicodidáctica, 14*, 279-297.

Rodríguez, C., García, J. N., González-Castro, P., Álvarez, D., Cerezo, R., & Bernardo, A. (2011). Written composition process, evaluation difficulties and modalities. An experimental study. *Learning Disabilities: A Contemporary Journal, 9*, 103-121.

Sanders, T., Spooren, W., & Norman (2001). Toward a taxonomy of coherence relations. *Discourse Processes*, *15*, 1-35.

Schuck, E. B., & Crinella, F. M. (2005). Why children with ADHD do not have low IQs. *Journal of Learning Disabilities, 38*, 262-280.

Spencer, S. L., & Fitzgerald, J. (1993). Validity and structure, coherence, and quality measures in writing. *Journal of Reading Behavior, 25*, 209-231.

Torrance, M., Fidalgo, R., & García, J. N. (2007). The teachability and effectiveness of strategies for cognitive self-regulation in sixth grade writers. *Learning and Instruction*, *17,* 265-285.

Torrance, M., & Galbraith, D. (2006). The processing demands of writing. In C. Mac Arthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 67-80). New York, NY: Guilford Press.

Yoshimasu, K., Barbaresi, W. J., Colligan, R. C., Killian, J. M., Voigt, R. G., Weaver, A. L., & Katusic, S. K. (2011). Written-language disorder among children with and without ADHD in a population-based birth cohort. *Pediatrics, 128*, 605-612.