

Orchestration of Writing Processes and Writing Products: A Comparison of Sixth-Grade Students With and Without Learning Disabilities

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The aim of the study was to compare two samples of sixth-grade Spanish primary students on coordination of writing processes measured by online or direct retrospection techniques and writing products. One group was comprised of 81 students with learning disabilities (LD), the other was made up by 80 typically achieving students. The results showed that students with LD spent more time on the task, but this generally included more interruptions and less involvement in editing, revising, reading, or changing the text. However, the findings did not highlight differences between the two groups with regard to the planning process. As for the modulation variables of writing, students with LD displayed less self-knowledge and self-regulation in composition writing, with higher writing self-efficacy beliefs than typical students. These factors probably influence the resulting texts, which showed poorer quality, structure, and coherence. The relationship between these types of variables is complex and should be explored further. This study highlights the theoretical and practical importance of studying the online processes that are developed in the composition writing of primary LD students.

Key Words: Writing Process, Learning Disabilities, Writing Competence, Metacognition of Writing, Knowledge of Writing, Self-Regulation, Self-Efficacy.

Considerable progress has been made in the field of writing research in recent year, in an attempt to understand the processes involved in writing. A large group of theoretical models of writing have tried to describe writing from cognitive or social perspectives (e.g., Alamargot & Chanquoy, 2001; MacArthur, Graham, & Fitzgerald, 2006). All these models, despite their diversity, try to explain the architecture of the writing processes, their components, and their organization as a recursive process, as well as the changeable components relative to the writer's motivation, attitudes, cognitive processes (working memory, knowledge in long-term memory), or metacognitive processes (self-regulation and metacognitive knowledge). In general, the models agree that writing is a demanding cognitive task that requires coordinated implementation of a large set of mental processes that must be performed in a simultaneous and recursive manner.

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This complexity demands multiple cognitive resources, such as attention control, self-regulation, working memory capacity, and so on. It also requires the use of specific writing skills and strategies that facilitate and organize the number of cognitive processes involved in the production of a written text and the cognitive demands of processing. For this reason, the development of writing competence is a challenging task for all students, and especially for students with learning disabilities (LD).

A review of empirical studies shows findings related to the differences between students with LD and their typical peers as follows. First, there are differences in the personal or emotional factors in writing, such as self-efficacy; students with LD generally overestimate their writing self-efficacy, which can be harmful and may lead to poor preparation, ineffective self-advocacy, and a lack of awareness of their strengths and weakness (Klassen, 2002a, 2002b, 2006). Second, there are variations with regard to their metacognition, knowledge, and self-regulation in writing. Students with LD tend to demonstrate less metacognitive awareness and generally focus on the concrete demands of tasks rather than on the more obscure evaluative or self-awareness skills required by metacognitive processes (Butler, 1998b). Also, students with LD have a less mature conceptualization of what composing involves (Graham, Schwartz, Charles, & McArthur, 1993) and a less coherent awareness of the writing process compared to their typically developing peers (Wong, Wong, & Blenkinsop, 1989). Third, differences were found in students' written products (Graham & Harris, 1989, 2002; MacArthur & Graham, 1987; Thomas, Englert, & Gregg, 1987).

As for the characteristics of the written products, the texts of students with LD are generally shorter, incomplete, with more superfluous data, poorly organized, with mistakes in structure, greater frequency of incoherence, and poorer in overall quality compared to the texts of typical peers (Graham, 1990; Graham, Harris, MacArthur, & Schwartz, 1991; MacArthur & Graham, 1987; Nodine, Barenbaum, & Newcomer, 1985; Thomas et al., 1987). These studies suggest that students with LD carry out little planning in their writing. The features of their compositions reflect a lack of competence in planning of writing and content generation as well as in their attempts to organize a structure for the compositions and to set the goals for the writing sub-processes (Hayes & Flower, 1980). Bereiter and Scardamalia (1987) found that students with LD tend to rely on a knowledge-telling strategy of writing, perhaps as a potentially adaptive response to the heavy processing demands that writing imposes on them (McCutchen, 2000). This contrasts with a knowledge-transforming strategy, which is more characteristic of expert writers or typically developing students.

Other features of the written products of students with LD reflect the greater difficulty they have in producing sentence structures, as seen in their use of shorter and fewer sentences and sentence-combining links (Gregg, 1986; Gregg, Hoy, McAlexander, & Hayes, 1991). Furthermore, several earlier research studies have demonstrated that students with LD make more spelling, capitalization, and punctuation errors than their typically developing peers (Fulk & Stormont-Spurgin, 1995; Graham et al., 1991; MacArthur, Graham, Schwartz, & Schafer, 1995). In addi-

tion, their texts are less legible and consistent than those written by typically developing students (Graham & Weintraub, 1996; MacArthur & Graham, 1987).

In short, all of these features suggest that the difficulties of students with LD may be found within the processes and mechanics of translating. These features show that LD students concentrate their efforts in the revising process on localizing and correcting the mechanical aspects of their compositions, such as spelling, changing words or phrase selections (Graham, 1997; MacArthur & Graham, 1987; McCutchen, 1995), and that they have problems with the other areas of the revision process. It seems that students with LD spend very little time revising, and they do not progress to a revision of the conceptual and linguistic characteristics of the text according to its audience and purpose. Rather, they carry out only a superficial and mechanical revision, thus lowering the overall quality of their compositions.

The research studies mentioned above constitute a comprehensive representation of the written products of students with LD in comparison to those of their typically developing peers. Thus, they provide indirect or anecdotal evidence about their writing processes, which strategies they favor in writing compositions, and what difficulties they have in managing the processes involved in composing. However, according to the most recent conceptual frameworks and the new methods of investigation applied in writing research, the emerging consensus is that is not possible, to comprehend the cognitive processes that occur during the writing process, that is, to understand completely what happens in the writer's mind during writing process, by looking only the written products. In order to appreciate fully the writing process requires complementary methods of written product analysis, such as real-time methods (Olive & Levy, 2002).

In recent decades, the number of studies emphasizing the analysis of written texts with a view to understanding the composing process has drastically decreased (Levy & Olive, 2002), in contrast to the explosion of the use of real-time methods in writing research (see Olive & Levy, 2002, for a review of methods and investigations). However, to our knowledge, few studies have employed these online research methods with the LD population, except from an instructional perspective in research by García and Fidalgo (2006) and García and de Caso (2006). We were unable to locate any published comparative studies involving students with LD and typically developing students that used real-time methods to study differences between their writing processes.

This is the main purpose of the present research. We compared the general temporal organization of the writing processes and their recursive nature and the subsequent influence on the text's quality in students with LD and typical students by combining a variant of the triple-task technique (Olive, Kellogg, & Piolat, 2002) with detailed written products analyses. In addition, we studied the differences between students with LD and typical students in writing metacognition and self-efficacy, given the key role that both can play in this complex and difficult task, which includes employing numerous cognitive processes recursively. Writing demands a behavioral engagement that requires students to exert greater effort and persist longer at tasks, which is related to self-efficacy. Moreover, writing tasks require a metacognitive awareness of domain-specific knowledge of writing, skills, and strategies, and extensive attention control and self-regulation of the writing

processes; both are related to the metacognitive dimension of writing. It is important to be familiar with the characteristics of LD students' metacognition and motivation (Troia, 2006), as skilled writing requires engagement of both cognition and motivation.

This research permits a greater understanding of the writing difficulties of students with LD, in terms both of their use and organization of the writing processes and their written products, as well as the metacognitive (knowledge and self-regulation) and motivational (self-efficacy) underpinnings of their writing difficulties. These findings allow for the development of specific and appropriate writing programs for students with LD, to help them use more effective approaches or strategies to composing, with a view to overcoming their writing difficulties and improving the quality of their written compositions and developing their writing competence.

Method

Participants

The sample was comprised of 81 Spanish sixth-grade, primary-school students with low achievement and/or LD and 80 Spanish sixth-grade typically achieving students, between 11 and 12 years old. The sample details are summarized in Table 1.

Table 1
Student Distribution by Group and Gender

	Students with LD	Typical Students	Total Gender
Male	49	48	97
Female	32	32	64
Total group	81	80	

As for the selection of LD or typical students, participating teachers informed us about the sixth-grade students who had some degree of low achievement and/or LD. Their statements were verified by psychoeducational teams, who assessed all the children using several methods, including IQ and aptitude tests, parent and teacher reports, observations, interviews with the students, and the students' grades. These data cannot be presented in this study, as the psychoeducational team kept the data confidential. Nevertheless, they confirmed that students had LD.

Certain students were excluded: (a) those who did not attend school regularly; (b) those who had a developmental disability such as mental retardation or autism and were diagnosed by Spanish psychoeducational teams as having special educational needs; and (c) those whose delay or difficulties could be attributed to a physical, psychological, or sensory disability, or a lack of schooling (García, Fidalgo, & Arias, 2006; Jiménez & Hernández, 1999).

The sample of students with LD was closely matched to the typical student sample on demographic features: middle socioeconomic and cultural level and belonging to the same urban context, in the north of Spain. Also, all the students were native Spanish speakers and used Spanish as their first language. The educational infrastructure (student-teacher ratio, resources, type of school, and so forth)

and students' experience in writing prior to this research were also closely matched between the schools and the classes where students were enrolled.

Measures

Writing process. These measurements were taken using a variant of the triple-task technique originally proposed by Kellogg (1987a, 1987b), which has been used previously by authors of different research projects with primary-aged children, both typical students and those with LD (García & Fidalgo, 2006; Torrance, Fidalgo, & García, 2007).

In this technique, while students composed their text, they heared auditory probes with a mean interval of 90 seconds. After probe detection, the students performed a directed and immediate retrospection about their thoughts at the moment the probed occurred. They chose from seven response categories, reduced from a longer list used with adult writers by Torrance, Thomas, and Robinson (1999), which were labeled and defined as follows: *Reading references* – reading information and data about the topic; *Thinking about content* – thinking about things to say in the essay; *Writing outline* – making a plan or notes about the essay that I am going to write; *Writing text* – writing my essay; *Reading text* – reading through part or all of my text; *Changing text* – making changes to my composition (correcting spelling mistakes, changing words, adding words, etc.); and *Unrelated* – doing or thinking something unrelated to the text (talking to my partner, looking for a pen, looking through the window, etc.).

Students were given a blank writing log divided into multiple sections listing the seven possible writing activities to reduce interference of the directed retrospection in the writing process. The students were first trained to identify their thoughts as examples of the seven categories. After training, the students' accuracy in using the categorization scheme was determined by playing a videotape of a writer thinking aloud while planning and drafting text and asking the students to indicate the writer's activity at each of 25 different points. Comparison of the students' categorization with that of an expert judge gave a mean agreement of .87 (kappa index) for the typical student group, and a mean agreement of .71 kappa index for LD group.

Written product. The written products were assessed using two types of measurements, subjective reader-based criteria and formal text-based criteria.

The text-based assessment used productivity measures. This type of assessment is concerned with the quantity of text produced, and consequently tallies the number of paragraphs, sentences, verbs, content words, functional words, determinants, and total number of words that the student wrote in his essay.

Coherence measures were also taken, including seven linguistic indicators of referential or relational coherence (Sanders, Spooren, & Noordman, 1992). Specifically, referential coherence was assessed by measuring students' use of anaphoric and lexical reference ties in their compositions. Relational coherence was assessed through the use of metastructural ties. These are the phrases that link sentences or highlight previous or subsequent textual content. Structural ties are the specific linguistic markers that are used to structure the information such as at *first, second, later*; connective ties refer to the linguistic markers that link the different

parts of text such as *and, beside, as well as, also*; reformulation indicators are the linguistic markers that summarize, explain, or reiterate a point in a different way; and argumentational ties are the linguistic marks that persuade or provide evidence such as *however* or *for example*. The total number of coherence ties was weighted for text length. Coherence-tie referential, relational, and total density coherence measures were calculated as the number of ties of a specific type and total ties per 100 words of text.

The reader-based assessment such as structure, coherence, and quality were taken following the criteria described by Spencer and Fitzgerald (1993), but with slight variation to make them appropriate for a comparative-contrast expository text. The quality of the essay was assessed using a 6-point scale from 1 (difficult to understand) to 6 (excellent), with ratings 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; (d) varied and interesting detail; (e) correct sentence structure; and (f) accurate punctuation, capitalization and spelling.

The essay structure was assessed on a 4-point scale from 1 (unstructured) to 4 (well structured). Ratings were based on the extent to which readers perceived 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 based on a definite scheme, (e) unity of theme within paragraphs and across the whole essay, and (f) a conclusion that reiterated the purpose of the paper.

The essay coherence was also assessed on a 4-point scale, from 1 (incoherent) to 4 (very coherent), with ratings based on the extent to which the reader perceived that (a) a topic or theme was identified and remained a focus of the essay, (b) the text included a context that orientated the reader, (c) information was organized in a discernible pattern which was sustained through the text, (d) sentences and paragraphs were cohesively tied, and (e) the discourse flowed smoothly.

Writing self-efficacy. Writing self-efficacy was measured by asking students to provide self-judgments of their ability to successfully perform various writing skills in the writing task according to their academic level. The writing self-efficacy scale consisted of eight items, four items applied before and four after the writing task, asking students how certain they were that they could perform specific writing skills on a scale from 1 to 9. The substantial skills listed included the quality of text, the generation of many good ideas, and the ability to write a text that the audience understands. The mechanical skills included spelling and punctuation and also a total writing self-efficacy belief. The questionnaire has an adequate reliability (Cronbach α 121 = .876; and Standardized α 121 = .931) for all the samples in this study; both for the total of the scale, and for each of the measurements (Cronbach α from .838 to .880). Similarly, the content and construct validity is assured as every item is adapted to Bandura's guide for constructing self-efficacy scales (Bandura, 2001).

Metacognitive knowledge of writing. Three questionnaires from the EPME instrument (Evaluación de los Procesos Metacognitivos de la Escritura – Assessment

Writing Metacognitive Process) were used to determine students' declarative, procedural, and conditional knowledge about writing. This assessment protocol was developed by our research team, who evaluated its validity using a sample of 968 students ranging from 8 to 18 years old.

The results confirmed that the metacognitive knowledge questionnaires of the EPME instrument fulfil the desired psychometric properties with a Cronbach α of .784 for internal consistency. In addition, the construct, structural, and content validity is adequate, so the device meets the desired psychometric properties (Fidalgo, 2005). All of questionnaires are composed of 10 items with four answer options related to knowledge of the substantive or higher-order cognitive processes, mechanical or lower-order cognitive processes in writing, other factors of variables related to writing and unrelated answers with different punctuation according to their suitability.

Declarative knowledge refers to what is known about oneself as a learner and about the influential factors of human thinking (Schraw, 2001). The declarative questionnaire of writing includes statements such as, What kind of writing strategies do you know? What kind of textual genres do you know? What is planning in writing? Procedural knowledge refers to knowledge about how to do things (Schraw, 2001). It can be described as awareness of the thought processes or the knowledge of the methods needed to achieve goals and the knowledge of how skills work and how they are to be applied. The procedural knowledge questionnaire refers to questions such as, How do you apply different writing strategies? How do you develop the writing process? How do you plan a text? How do you revise your text? Finally, conditional knowledge refers to knowing when and why to use declarative and procedural knowledge (Schraw, 2001; Schraw & Moshman, 1995), or where to use them (Biggs, 1999); that is, their appropriate use according to time, place, and moment. The conditional knowledge questionnaire refers to when to use a specific writing strategy, which writing strategies are most suitable for different kinds of texts, why to use a specific writing strategy for a specific moment of the writing process, and when and why to use a specific textual genre. The measures, scores and some examples of metacognitive questionnaires that comprise the EPME are described below and summarized in Table 2.

Self-regulation of writing. Two process logs from the EAE instrument (Evaluación de la Auto-regulación en la Escritura – Self-Regulation Writing Assessment) were employed to assess self-regulation strategies in writing. These tests were designed by our research team, and were validated in a previous study with a sample comprised of 968 students (509 males and 459 females) from 3rd (primary school) to 11th grade (high school), ranging in age from 8 to 18 years old.

Table 2
Assessed Aspects, Measures, Scores, and Examples of Items of Metacognitive Knowledge in Writing

Assessed Aspect	Instrument	Task	Scores	Examples of Items
Declarative knowledge of writing	EPME – Assessment Writing Metacognitive Process	Questionnaire • 10 items • 4 answer options	Quantitative score: 13 - 81	• *In a compare-contrast text …* • *An essay is …* • *In an opinion essay …*
Procedural knowledge of writing	EPME – Assessment Writing Metacognitive Process	Questionnaire • 10 items • 4 answer options	Quantitative score: 15 - 79	• *To start a composition you must …* • *To revise a text you must …*
Conditional knowledge of writing	EPME – Assessment Writing Metacognitive Process	Questionnaire • 10 items • 4 answer options	Quantitative score: 15 - 82	• *Why do you plan/revise your text …* • *When do you write a draft …*

The results confirmed that the EAE test fulfills the desired psychometric properties with a high reliability (Cronbach α of .88) for internal consistency. In addition, the construct, structural, and content validity are adequate, so we can state that the device meets the desired psychometric properties (Fidalgo, 2005). Both process logs solicit specific information from students on how they complete two specific writing tasks, narration and composing a text with a free choice of topic (Faigley, Cherry, Jolliffe, & Skinner, 1993).

The process log for narration includes a regulatory checklist for three self-regulation strategies: planning, monitoring, and evaluation. It is designed to be answered once students had completed the final text of the narration. The process log for the free-topic composition includes three regulatory checklists for three self-regulation strategies: planning, monitoring and evaluation. Each process log is designed to be completed at different times during the process of composing. The planning process log is answered prior to writing. The monitoring process log is filled in once they have begun writing, and the evaluation process log is designed to be answered after students have completed their final draft. Some of the items included in the self-regulatory checklist are summarized in Table 3 next to a description of both process logs.

Procedure

Students completed the instruments in small groups in their schools in the middle of the second semester during two assessment sessions. In the first session, students were instructed to use the writing process self-report method, and their reliability at coding writing behavior was assessed. Later they completed the writing self-efficacy questionnaire and the writing task. This consisted of a compare-contrast essay based on topics that were related to subjects previously covered in the students' sixth-grade curriculum. Student groups wrote about the similarities and

Table 3
Assessed Aspects, Measures, Scores, and Examples of Items of Self-Regulation Strategies in Writing

Assessed Aspect	Instrument	Task	Scores	Examples of Items
Self-regulation strategies of writing: planning, monitoring and evaluation	EAE – Process log for narration	A general self-regulatory check list • 25 items • 2 answer options: yes or no	Quantitative score: 0-25	*I have remembered other stories which I know. I have written the narration with a specific purpose. I have read the narration when I had finished it. I have read the narration while I was writing.*
Self-regulation strategies of writing: planning, monitoring and evaluation	EAE – Process log for redaction	Three self-regulatory check lists • Planning (9 items) • Monitoring (10 items) • Evaluation (11 items) • 3 answer options: nothing (0), regular (1), a lot (2)	Quantitative score: • Planning (0-18) • Monitoring (0- 10) • Evaluation (0-11) • Total (0- 39)	*I have ideas about the theme. I have written a draft. I have been reading the text while I was writing. I have read the text once it is finished.*

differences between demonstratives and possessives. Students were provided with reference sheets (approximately 500 words of text) providing topic-relevant information.

In the second session, students completed the process logs of the EAE instrument (Self-Regulation Writing Assessment) and the three metacognitive writing questionnaires of the EPME instrument (Evaluación de los Procesos Metacognitivos de la Escritura – Metacognitive Writing Process Assessment).

Results

A multivariate analysis was carried out to examine the differences between groups (typical students and students with LD) as independent variables and all measures as dependent variables. To account for differences in variability potentially linked to ceiling or floor effects, we used the standardized variables to ensure that every variable had the same mean and standard deviation scale, as well as normal distribution. The results revealed a significant main effect for group differences (λ = .066; $F = 6.698$; $p < .001$; $\eta^2 = .934$) with a large size effect as the eta squared statis-

tic larger than 0.14. Below, we first describe the differences between the typical students and those with LD in the writing process and products. Then, we examine the variations as regards self-efficacy, writing metaknowledge and self-regulation.

Writing Process

The time spent on each of the seven writing log activities was estimated by multiplying the frequency of each activity in the writing log by the mean inter-tone interval (90 seconds). The time spent on each activity is clearly dependent, in part, on the total writing time. To control for this, rather than presenting the time spent on each of the activities, we report the percentage of time calculated as the time spent on each activity per total time of writing process, excluding the unrelated process. The total time of writing processes includes time dedicated to all processes; however, the percentage of writing process time excludes unrelated process. We calculated the percentage of time per activity for all the writing processes and their temporal organization distributed over the three moments. These data were analyzed using a multivariate analysis of variance for the writing process measures among the groups. Table 4 summarizes the significant results related to percentage of time spent on activities during the writing process.

The total time of writing process for students with LD, which includes the unrelated process category, was significantly higher than for typical students with a medium effect size, $F(2, 118) = 8.617$; $p < .004$; $\eta^2 = .058$. The opposite tendency was found in the percentage of time spent on the writing process when the unrelated category is excluded, which was significantly higher for typical students than for those with LD for overall time, $F(2, 118) = 4.148$; $p < .044$; $\eta^2 = .029$, in the second quarter, $F(2, 118) = 4.044$; $p < .046$; $\eta^2 = .028$, and in the third quarter, $F(2, 118) = 6.530$; $p < .012$; $\eta^2 = .045$, which have a small size effect. These findings prove that students with LD carry out more unrelated processes during their composition writing than their typically developing peers. They pay less attention when writing compositions, with significantly more interruptions than their typical peers. Moreover, students with LD spend less time on the writing processes than their typical developing peers.

On the whole, the greater percentage of time spent on the writing processes by typically developing students is due to significantly more time being dedicated to the translating process, $F(2, 118) = 4.821$; $p < .030$; $\eta^2 = .034$; specially, time dedicated to revision processes, such as the percentage time of reading text, $F(2, 118) = 25.494$; $p < .001$; $\eta^2 = .155$, which has a large effect size, and the percentage time changing text, which shows medium effect size, $F(2, 118) = 8.049$; $p < .005$; $\eta^2 = .055$. However, there are no significant statistically differences in the planning process between the two groups of students.

With regard to the temporal organization of the writing processes, statistically significant differences were found between typical students and those with LD when we analyzed the distribution of the writing process activities over the entire writing process, divided in three moments.

Table 4

Significant Results of a Multivariate Analysis of Variance for the Writing Process Measures for the Typical Students and the Students with LD

	With LD Group (N = 81)		Typical Student Group (N = 80)				
	M	Dv.T	*M*	Dv.T	*F*	$p <$	η^2
Writing process measures							
Total time of writing process	783.91	408.68	618.75	241.65	8.617	.004	.058
Percentage time of writing process	91.37	17.41	95.96	7.72	4.148	.044	.029
Percentage time of writing process second quarter	30.26	7.55	32.23	3.38	4.044	.046	.028
Percentage time of writing process third quarter	27.73	9.81	31.18	5.79	6.530	.012	.045
Percentage time of writing text	55.80	26.75	46.99	20.65	4.821	.030	.034
Percentage time of reading text	5	9.05	14.23	12.32	25.494	.001	.155
Percentage time of changing text	4,04	7.27	8.26	10.10	8.049	.005	.055
Writing process measures first stage							
Percentage time of reading text	1.35	5.85	6.28	14.28	7.078	.009	.048
Writing process measures second stage							
Percentage time of reading text	3.81	10.50	15.54	22.28	15.760	.001	.102
Writing process measures third stage							
Percentage time of reading references	10.11	21.20	4.17	13.18	5.924	.016	.041
Percentage time of reading text	8.87	19.98	20.84	26.23	9.231	.003	.062
Percentage time of changing text	7.11	16.07	19.40	25.60	11.551	.001	.077

Note. We only include the statistically significant results ($p < .05$) η^2 (eta-squared statistic) = Estimates of effect size. The Cohen (1988) rule signals that .01 - .06 (small effect); > .06 - .14 (medium effect); > .14 (large effect).

Once again, the main differences between the writing processes of the two groups of students are related to the revision process. These processes were significantly more manifest in all the writing process of typical students. Specifically, the percentage of time spent reading the text was statistically higher in the typical students group than in the students with LD, in the first, $F(2, 118) = 7.078$; $p < .009$; $\eta^2 = .048$, and the second stage of writing process, $F(2, 118) = 15.760$; $p < .001$; $\eta^2 = .102$, with a medium effect size.

Finally, in the third stage of the writing process, the typical student group devoted a statistically significant greater percentage of time to the revision processes than the LD group. This refers to processes such as the percentage of time spent reading text, $F(2, 118) = 9.231$; $p < .003$; $\eta^2 = .062$, and the percentage of time dedi-

cated to changing text, $F(2, 118) = 11.551$; $p < .001$; $\eta^2 = .077$; both had a medium effect size. However, the students with LD spent statistically significant more time reading references in the third stage of writing process, $F(2, 118) = 5.924$; $p < .016$; $\eta^2 = .041$.

Writing Products

According to the findings of previous research studies, there are significant differences between the writing products of typical students and those with LD, resulting in a generally higher quality of composition among the typical student group. This was supported in terms of informal, reader-based measures and more formal text-based measures as well. Table 5 summarizes the significant findings from product measures.

Table 5

Significant Results of a Multivariate Analysis of Variance of the Writing Product Measures for Typical Students and Students with LD

Measures	Students with LD (N = 81)		Typical Students (N = 80)				
	M	Dv.T	*M*	Dv.T	*F*	*p*<	η^2
Text-based measures							
Productivity	50.51	23.99	81.93	24.09	60.170	.001	.302
Referential coherence	4.78	4.48	9.97	5.57	36.868	.001	.210
Relational coherence	2.88	2.25	6.78	3.58	58.953	.001	.298
Density of coherente	13.91	7.15	20.15	7.25	26.436	.001	.160
Reader-based measures							
Structure	1.36	.56	2.03	.71	37.466	.001	.212
Coherente	1.57	.69	2.51	.5	86.522	.001	.384
Quality	1.57	.73	2.38	.56	53.676	.001	.279

Note. We only include the statistically significant results ($p < .05$) η^2 (eta-squared statistic) = Estimates of effect size. The Cohen (1988) rule signals that .01 - .06 (small effect); > .06 - .14 (medium effect); > .14 (large effect).

On the reader-based measures, summarized in Table 5, the differences between the typical students and students with LD were significant, with a large effect size. The typical students elaborated a significantly better text in terms of structure, $F(2, 118) = 37.466$; $p < .001$; $\eta^2 = .212$, of coherence, $F(2, 118) = 86.522$; $p < .001$; $\eta^2 = .384$, and quality measures, $F(2, 118) = 53.676$; $p < .001$; $\eta^2 = .279$.

With regard to the text-based measures, summarized in Table 5, the typical student group obtained significantly higher scores than the LD group in all measures; for productivity in number of words, $F(2, 118) = 60.170$; $p < .001$; $\eta^2 = .302$. The same trend was seen for types of coherence, referential, $F(2, 118) = 36.868$; $p < .001$; $\eta^2 = .210$; relational, $F(2, 118) = 58.953$; $p < .001$; $\eta^2 = .298$,; and total density of coherence, $F(2, 118) = 26.436$; $p < .001$; $\eta^2 = .160$. It is important to note the large effect size for all of them.

Writing Self-Efficacy

Statistically significant differences were found between the typical students and the students with LD in all the writing self-efficacy measures with a medium

effect size, total, $F(2, 118) = 10.189$; $p < .002$; $\eta^2 = .068$; total previous writing self-efficacy, $F(2, 118) = 12.823$; $p < .001$; $\eta^2 = .084$; and total after, $F(2, 118) = 7.253$; $p < .008$; $\eta^2 = .050$. The analysis confirmed that the students with LD showed a statistically significant higher writing self-efficacy than the typical student group. Figure 1 illustrates the differences in writing self-efficacy between the two groups of students.

Figure 1. Significant differences of writing self-efficacy measures between the groups of typical students and the group of students with learning disabilities.

Metacognitive Knowledge of Writing

With regard to the metacognitive knowledge of writing of the group of students with LD compared with the typical student group, the two groups differed significantly, with a large effect size for all types of metacognitive knowledge of writing. The results are as follows; declarative, $F(2, 118) = 30.101$; $p < .001$; $\eta^2 = .178$; procedural, $F(2, 118) = 24.001$; $p < .001$; $\eta^2 = .147$; conditional, $F(2, 118) = 45.973$; $p < .001$; $\eta^2 = .249$; and total, $F(2, 118) = 44.486$; $p < .001$; $\eta^2 = .242$. The mean scores of metacognitive knowledge of writing for the typical student group were higher than for the group of students with LD in all four measures of metacognitive knowledge of writing. Figure 2 summarizes these differences between the groups.

Self-Regulation of Writing Process

As for the writing self-regulation strategies, the typical student group showed a statistically significant greater use of the self-regulation strategies in composition writing than the LD group, such as planning strategies, monitoring strategies, and evaluation strategies in both writing tasks, narration and free-topic composition. Table 6 summarizes the significant results. It is specifically important to note that they show a large effect size, which proves their practical significance.

Figure 2. Significant differences of writing metacognitive knowledge between the groups of typical students and the group of students with learning disabilities.

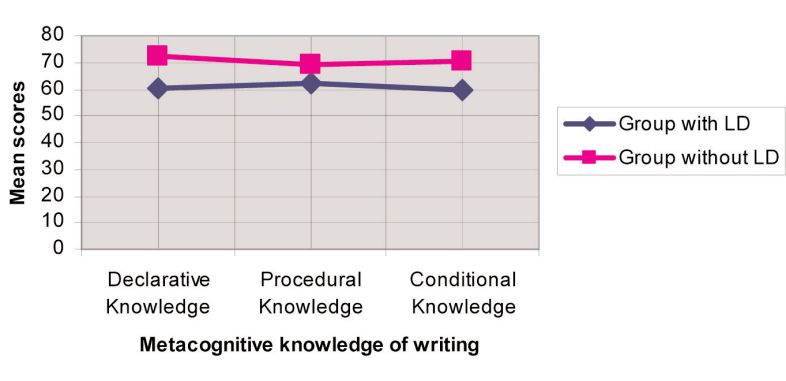

Table 6

Significant Results of Multivariate Analysis of Variance in the Self-regulation of Writing Measures between the Groups of Typical Students and the Group of Students with LD

EAE Self-Regulation Measures in Narration and Composition	Learning Disabilities (N = 81)		Typical Students (N = 80)				
	M	Dv.T	*M*	Dv.T	*F*	*p*<	η^2
Self-regulation Strategies in narration							
Planning self-regulation strategies	1.7	.94	2.44	1.03	20.134	.001	.127
Monitoring self-regulation strategies	3.14	2.03	6.01	1.88	75.839	.001	.353
Evaluation self-regulation strategies	1.74	1.65	4.67	1.784	102.051	.001	.423
Total self-regulation strategies	6.58	3.24	13.13	3.43	135.130	.001	.493
Self-regulation strategies in redaction							
Planning strategies	10.42	4.07	13.04	2.7	20.450	.001	.128
Monitoring strategies	10.38	4.47	14.4	2.68	42.370	.001	.234
Evaluation strategies	11.19	5.57	17.19	3.54	58.775	.001	.297
Total self-regulation strategies	31.99	12.65	44.64	7.9	51.165	.001	.269

Note. We only include the statistically significant results ($p < .05$) η^2 (eta-squared statistic) = Estimates of effect size. The Cohen (1988) rule signals that .01 - .06 (small effect); > .06 - .14 (medium effect); > .14 (large effect).

Discussion

This study examined the differences in the general writing process and its temporal organization of sixth-grade students with LD compared with typically achieving students, using a real-time method of writing research. In addition, the study aimed to assess the differences in these students' written products and in the modulating variables of the writing process, such as self-efficacy, self-regulation, and metacognitive knowledge of writing. Our findings allow us to draw some conclusions about the writing process in students with LD, the differences that exist when they are compared to their typically developing peers, and the difficulties the former group have in composition writing.

In general, the students with LD perform more unrelated processes during their composition writing than their typical peers, paying less attention to the writing task with more interruptions of the task. They display a reduced use of the processes involved in writing, which probably influences the written product. Further, students with LD perform inappropriate processes (for example, at the end of the task, they are involved in reading references). They spend more time on the task but less of this time is dedicated to processes related to the task.

Writing tasks make higher processing demands on LD students than on their typically achieving peers. This is because they have to manage and regulate the complex set of processes associated with creative writing, such as planning, text production, or revision (Alamargot & Chanquoy, 2001). Furthermore, they also have to manage the processes associated with the transcription process if they have not yet mastered the mechanics of writing (Graham & Harris, 2000), which could result in a cognitive processing overload within the constraints of working memory (McCutchen, 2000; Torrance & Galbraith, 2006). Logically, the higher processing demands of writing in LD students would suggest that these students spend more time on the writing process. However, the results showed the opposite. The distinction between students with LD and typical students, in a similar way to novices compared to experts, could be the overall time on writing task (Hayes & Nash, 1996).

Another difficultly that presented itself in the writing processes of students with LD was the significantly higher score of unrelated processes during composition writing. This finding shows that students with LD spend less time on their work in the writing task and more time on non-productive behavior than their typically developing peers. This may be explained by behavioral characteristics such as inattention and distractibility, which are frequently present in students with LD (Mercer & Pullen, 2005). This feature of interference in the writing process of students with LD, along with the demands of extensive self-regulation and attention control in writing to manage the writing processes involved in composing a text (Graham & Harris, 2000; Kellogg, 1987a; Ransdell & Levy, 1996; Zimmerman & Risemberg, 1997), may explain the high difficulties in writing of LD students.

With regard to the writing strategies used in their writing composition and the orchestration, our findings allow us to draw significant conclusions regarding the writing strategies of each groups of students studied

First, there were no significant differences in their planning processes, such as thinking about content and writing outline. A possible explanation for this find-

ing may be that primary-age students, such as those participating in this sample, typically spend little or no time preplanning their text (De La Paz, 1999), especially prior to writing (McCutchen, 2006). Both students with LD and typical students may follow a knowledge-telling strategy in their compositions (Bereiter & Scardamalia, 1987). Although the amount of time spent planning is not significantly different, one key different between the two groups of students may be the nature of planning. In particular, whether planning is devoted to generating content, to rhetorical goal-setting, to problem solving or pre-planning/advance planning (McCutchen, 2006). However, this difference is unlikely, as conceptual planning is relatively rare until the writer is 12 years old or even in adolescence (McCutchen, 2006).

A detailed assessment of the planning process in students with LD and their typically developing peers was not possible, although a writing log method was used. Hence this constitutes a limitation of this study. The detailed analysis of types of planning requires a more sensitive measure of direct retrospection in the writing process, such as thinking-aloud methods, and is considered as a suggestion for future research. A more sophisticated analysis might yield more enlightening results regarding the differences in the writing processes between these two groups of students. However, it is possible that the use of the thinking-aloud method is too reactive for young writers (Olive et al., 2002), especially for young writers with LD, as it could disrupt or misrepresent the writing process. For this reason, it would be necessary to conduct preliminary studies to detect any potential problems related to the use of thinking-aloud methods with the LD population.

Contrary to the results concerning the planning process, the analysis confirmed significant differences in the translating or editing and revising process of students with LD and their typically developing peers. As for the translating processes, the students with LD devote significantly more time to editing than their typical peers. The differences between the editing processes do not discriminate their specific writing strategy. However, the significant differences between the groups as regards writing strategies could be connected to the revision process. Typically developing students dedicate significantly more time to the revision processes, such as reading and changing text, than students with LD. As for the orchestration of the writing process, the revision processes in typically achieving students, compared to those with LD, are present throughout the writing process, with reading processes evident while writing the composition and with changing text seen specifically in the last stage of writing process.

Bearing in mind the high impact of the revision process on the quality of texts (Hayes, 1996, 2004), these findings could explain the significantly better general quality of the texts written by typical students compared with their LD peers. However, the specific causal relationships between writing processes and products need future research. Although the time spent on the revision process, in reading and changing text, is an important indication of the writing strategy used, it would be interesting to carry out a more detailed analysis of the revision strategy. This could help to determine the difficulties that LD students experience with specific levels of the revision process, such as employing a revision schema focusing on the mechanical aspects of writing, developing an inadequate representation of audience

or purpose of text, or employing non-sophisticated reading strategies (Hayes, 1996, 2004). This issue may be the focus of future research, given that the revision process seems to be the key difference between the writing process of typical students and those with LD at least at this stage. The possible limitations connected to the use of more detailed real time methods with the LD and young population must be considered (Olive & Levy, 2002).

As for the written products, we found that typically developing students tend to produce better quality texts, as would be expected. It is thought that the differences in the orchestration processes could affect the product (quality, structure, coherence), but more experimental and instructional research is required to confirm this possibility. It is possible that it is not only the processes involved that account for the poor quality of the texts produced by LD students. Other variables, such as metacognitive knowledge of writing, self-regulation of writing processes, or self-efficacy of writing processes, are also influential.

As for the modulating variables of writing assessed, the results of the present study echo the findings of previous research on to LD students' metacognition and self-efficacy in writing. Specifically, with regard to metacognition in writing, LD students possess a lower metacognitive knowledge and poorer self-regulation strategies in writing than their typically achieving peers, and this has negative implications for effective and efficient task performance (Troia, 2002, 2006). On the contrary, students with LD showed higher writing self-efficacy beliefs than their typical peers. Nevertheless, they also demonstrated poorer writing competence than the typically developing students. Optimistic estimates of one's efficacy are thought to increase effort and persistence in tasks and promote achievement; a certain degree of optimism or positive bias is considered to be advantageous (Bandura, 1997). However, when there is a considerable miscalibration in the accuracy of one's beliefs about potential performance, this may be detrimental and can create problems (Bandura, 1989). That is, a high level of self-confidence in writing competence is not sufficient to produce success if the requisite knowledge and self-regulation skills are absent and this is a potential problem for students with LD. It would have been interesting to study writing self-efficacy calibration as well, considered as the degree of congruence between efficacy beliefs and actual performance, assessed by comparing the mean efficacy ratings with task performance (Klassen, 2002a). This study could provide some informative results about the possible overestimation of writing self-efficacy in students with LD, compared to the findings of previous researchers (Klassen, 2002a, 2002b, 2006).

In conclusion, we found that LD students had poor or low metacognitive knowledge and self-regulation of the writing processes and high writing self-efficacy, signaling that these modulation variables could account for the low quality and poor structure and coherence of the written compositions of the LD population. The causal relationship between both types of variables has to be contrasted in the future, but the research presented here shows the possibility of a relationship between the written product and processes, with respect to the metacognitive processes or motivational variables. These results are congruent with the evidence found in the relevant literature. For example, Botsas and Padeliadu (2003) report that students with reading difficulties appeared to be less mastery oriented and more

performance avoidant than students without reading difficulties. Similarly, students with reading difficulties used less sophisticated and complex strategies. In our study we found that the students with LD spent more time on non-task activities but also that they spent less time on the appropriate strategies.

This study has shown that students with LD spend more time realizing the actual task but less time on the processes directly related to the writing task, combined with more interruptions of the task (greater distractibility), less revision and reading or changing the texts, poorer quality and less productivity of texts, with less self-knowledge and self-regulation, and high estimation of their writing abilities. The specific causal relationships between these aspects remain unknown. We need more research in the future about these causal relations, instructional and experimental, to account for this complex relationship, and we need to develop a theoretical model related to this type of variables.

In spite of this shortcoming, it can be asserted that it is possible to assess the writing processes using online techniques and that the presence of some type of relationship between among the processes and products of the writing has been demonstrated, and that this type of relationship is different for students with LD compared with their typical peers.

Finally, based on these findings, it is possible to highlight several implications for teachers' practice. It is considered necessary to develop specific training of the cognitive strategy instruction in writing for students LD. This helps them to simplify the cognitive demands of writing through the use of specific cognitive strategies of planning or revising. This will foster improvement of students' self-regulation skills and behaviors, which help them to focus on the writing task and control and manage it. It could promote the self-knowledge and self-regulation functions associated with writing metacognition, thus improving the accuracy in the calibration of writing self-efficacy beliefs in students with LD (Butler, 1998a; Meltzer, Roditi, Houser, & Perlman, 1998). A considerable number of researchers have provided substantial evidence of the efficacy of the cognitive strategy instruction in improving the writing performance of students with LD (Graham, 2006; Graham & Harris, 2003; Graham & Perin, 2007; Troia, 2006; Wong, Harris, Graham, & Butler, 2003).

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Authors' Note

During this research funds from the Dirección General de Investigación del Ministerio de Educación y Ciencia de España MEC-SEJ 2007-66989 (2007-2010) [General Research Board of the Spanish Ministry of Education and Science], and FEDER funds from the European Union were awarded to the principal researcher (J. N. García). A short version of this paper was presented at a symposium in Burlington, Massachusetts, October 2005, at the 15th World Congress on Learning Disabilities organized by Learning Disabilities Worldwide. We are very grateful to Jenny Gunn for the English correction.

Received August 2, 2007
Revised December 12, 2007
Accepted December 17, 2007