Research Article

Hammill Institute on Disabilities

Journal of Learning Disabilities
2023, Vol. 56(5) 410–420

DOI: 10.1177/00222194231157089
journaloflearningdisabilities.sagepub.com
SAGE

Copy Skills and Writing Abilities in Children With and Without Specific Learning Disabilities

Anna Maria Re, PhD[1], Francesca De Vita, MD, PhD[1], Cesare Cornoldi, Professor[2], and Susanna Schmidt, PhD, Associate Professor[1]

Abstract

Copying a text quickly and accurately is important both in school and in daily life. However, this skill has never been systematically studied, either in children with typical development (TD) or in children with specific learning disabilities (SLD). The aim of this research was to study the features of a copy task and its relationship with other writing tasks. For this purpose, 674 children with TD and 65 children with SLD from Grades 6 through 8 in Italy were tested with a copy task and other writing assessment tasks, measuring three aspects of writing: handwriting speed, spelling, and expressive writing. Children with SLD performed worse on the copy task, both in terms of speed and accuracy, than children with TD. Copy speed was predicted by grade level and by all three major writing skills for children with TD but only by handwriting speed and spelling for children with SLD. Copy accuracy was predicted by gender and the three major writing skills for children with TD but only by spelling for children with SLD. These results suggest that children with SLD also have difficulty copying a text and benefit less than children with TD from their other writing skills.

Keywords

learning disabilities, orthography, writing

The ability to copy words or texts efficiently is important and necessary in many situations in school and in everyday life. Efficient copying involves primarily two aspects: *speed* (the ability to copy a sufficient number of words in a limited amount of time) and *accuracy* (the ability to avoid spelling errors when copying). To date, however, this type of task has rarely been studied by researchers. The few existing studies (e.g., Arfè et al., 2020; Candela et al., 2012; dos Santos et al., 2021; Re & Cornoldi, 2015) suggest a relationship between handwriting speed and spelling that has been differently explained. According to some authors, children with spelling difficulties—and especially with dyslexia—may have a comorbidity with graphomotor control problems; this could slow down their handwriting speed (Di Brina et al., 2018; Haslum & Miles, 2007). According to other authors, the slowness of some children could be due to spelling uncertainties that typically occur in children with specific learning disabilities (SLD; Kandel & Perret, 2015; Lambert et al., 2011). Indeed, Kandel and Perret (2015) observed an influence of orthographic difficulty on graphomotor performance in a word copy task that required participants to copy a series of words varying in frequency and regularity. The results showed that participants had more difficulty (i.e., were slower) when the words to be copied had orthographic irregularities than when they were infrequent. Similarly, Arfè et al. (2020) found that although a group of children with dyslexia showed a significant deficit in graphomotor processes, orthographic complexity affected their handwriting performance more than the visual-motor difficulties of the task. In summary, word copying appears to be a complex task that is influenced not only by handwriting speed but also by other writing skills.

If copying words is already a complex task, copying a text is an even more complex one because it involves many different cognitive processes (Adi-Jafa et al., 2007; Tressoldi et al., 2012). Copying a text first requires that a word or sequence of words be read and stored in the phonological buffer. If possible, the words must then be associated with their lexical and orthographic representations in long-term memory; otherwise, they must be segmented into

[1]University of Turin, Italy
[2]University of Padua, Italy

Corresponding Author:
Anna Maria Re, Associate Professor, Department of Psychology, University of Turin, Via Verdi 10, 10124 Turin, Italy.
Email: annamaria.re@unito.it

their letters by looking back at the written words. Particularly for difficult words, it can be helpful to look back at the written material being copied (Tressoldi et al., 2012). Thus, copying a text involves efficient reading, retrieving orthographic representations from long-term memory, using working memory (to retain words and their segments in short-term memory), controlling attention (to organize the different processes and switch attentional focus between the original source and the sheet of paper used for copying), and writing processes (Cornoldi et al., 2022). As a result, children may make mistakes or be slow because of poor reading skills, difficulty in retaining information in short-term memory, inability to accurately match words letter by letter, slow writing, or because they have an inaccurate orthographic representation of the word (Re & Cornoldi, 2015). As all of these aspects may be impaired in children diagnosed with SLD, it can be predicted that these children will also have difficulty in a copy task.

Writing skills, however, include not only handwriting and spelling but also a third fundamental skill, expressive writing (e.g., Tressoldi et al., 2012). Apparently, this skill does not seem to be related to copying ability, but a number of influences can be predicted, especially when the task requires copying a text. Indeed, familiarity with the linguistic structure of texts, short-term ability to remember word sequences, and the ability to manage two simultaneous demands (i.e., thinking about the content and writing) that affect expressive writing (Re et al., 2007) may also affect the ability to copy a text efficiently. The reciprocal influences between the different aspects of writing may indeed be particularly important when the child has to copy not only a limited number of individual words but a whole text and is under time pressure. Regarding the latter case, Tressoldi et al. (2012) validated a copy task in which children had to copy a complex text within 5 min. Given this time constraint, it is unlikely that children will be able to copy the text letter by letter, so not only handwriting speed but also orthographic and expressive skills play an important role. Candela et al. (2012), who conducted this copy task with primary school children, found that it is well suited to distinguish between children with good and poor spelling skills. Furthermore, when comparing children with typical development (TD) and a small group of children with dyslexia, Re and Cornoldi (2015) confirmed the good discrimination ability of this copy task.

In summary, empirical evidence suggests that a copy task examines an important aspect of children's writing ability and has a good potential to identify a specific difficulty of children with writing problems. However, the existing studies on copying ability have not extensively examined the case of children with SLD. Moreover, they have not systematically examined the relationship between the performance in a copy task and in other writing tasks.

The Present Study

The present study aimed to systematically investigate the writing skills of Italian children using a test battery assessing handwriting speed, spelling skills in different dictation tasks, expressive writing skills in the production of different types of texts, and copy skills (Batteria per la Valutazione della Scrittura e della Competenza Ortografica-3 [Battery for the Assessment of Writing and Spelling Skills-3], BVSCO-3; Cornoldi et al., 2022). The study, which was part of a project to obtain new normative data for this writing battery, assessed the skills of a large and representative group of more than 700 sixth- to eighth-grade students, including a majority of children with TD but also a group of children with SLD. We chose to focus on middle school children for two reasons: (a) most research on this topic has involved children of primary school (e.g., Candela et al., 2012; Re & Cornoldi, 2015), and (b) we wanted to identify the factors underlying copying ability at an age when spelling skills should be rather consolidated (at least for Italian children, since Italian has a transparent orthography).

The study aimed at addressing the following research questions:

Research Question 1 (RQ1): Do children also make spelling errors when copying a text, and does this especially occur for children with SLD?
Research Question 2 (RQ2): Can writing skills be divided into the following three main components: handwriting speed, spelling, and richness of expressive writing?
Research Question 3 (RQ3): Can these three components (if confirmed by previous factor analyses) predict copying ability, and are the writing skills that predict copying performance for children with SLD the same as for children with TD?

Method

Participants

Participants were 674 sixth- to eighth-grade students with TD attending schools in different regions of Italy and representing the Italian population. These children were compared with a group of 65 children attending the same types of schools and diagnosed with SLD by a specialized team (consisting of a child psychiatrist, a psychologist, and a speech therapist) according to the Italian law on SLD (Law 170/2010) and the Italian National Guidelines for SLDs (Istituto Superiore di Sanità [Italian National Institute of Health], 2011). More specifically, according to the guidelines, children with SLD were assessed with a series of achievement tests and had scores below the predefined cutoffs (2 *SDs* or the 5th percentile), with an average IQ, and

Table 1. Main Characteristics of the Children With Typical Development (TD) and the Children With Specific Learning Disabilities (SLD) in the Study.

	Children with TD					Children with SLD				
				Age					Age	
Grade	*n*	Boys, *n* (%)	Girls, *n* (%)	*M*	*SD*	*n*	Boys, *n* (%)	Girls, *n* (%)	*M*	*SD*
6	229	102 (44.5)	127 (55.5)	138.8	3.8	19	11 (57.9)	8 (42.1)	140.0	3.7
7	236	117 (51.8)	109 (48.2)	150.7	4.3	21	14 (66.7)	7 (33.3)	149.3	2.9
8	209	86 (41.2)	123 (58.8)	162.7	3.9	25	18 (72.0)	7 (28.0)	162.7	3.9
Total	674	305 (45.9)	359 (54.1)	150.4	10.5	65	43 (66.2)	22 (33.8)	151.8	10.1

their learning disabilities were not due to neurological or sensory disorders or to sociocultural or linguistic disadvantages. Table 1 shows the main characteristics of the two groups.

The two groups were compared in terms of age and gender. We found no significant difference in age, $t(737) = 1.01$, $p = .311$, while there was a significant difference in gender, $\chi^2(1) = 9.70$, $p = .002$, with a higher percentage of boys in the group with SLD than in the group with TD. This gender difference is not surprising, as it has been shown that SLDs are more common in males than females (American Psychiatric Association [APA], 2013).

Tasks

To assess children's writing skills, we used the BVSCO-3, one of the most widely used writing batteries in Italy. The BVSCO-3 is a standardized test battery that demonstrated good reliability and good external and concurrent validity in a series of studies (e.g., Candela et al., 2012; Cornoldi et al., 2010; Dovigo & Re, 2013). For each task, we report test–retest reliabilities as presented in the manual (Cornoldi et al., 2022).

The writing tests include a copy task and a series of other tasks that can be divided into three categories: handwriting speed, dictation, and expressive writing. As recommended in the battery manual, for all tasks (except the "le" graphemes task, see below), children can choose the writing character they prefer and typically use (i.e., block letters or cursive, lowercase or uppercase) to make them feel more comfortable and perform at their best.

Copy task. The copy task involves copying as many words as possible in 5 min and, as mentioned earlier, children can choose the character they prefer. The parameters considered are the number of words copied and the percentage of errors (words copied incorrectly/number of words copied × 100). The task presents both spelling and syntactic difficulties. For example in the following sentence: "Di neologismi ce n'è di multiformi varietà" [There is a great variety of neologisms], *neologismi* is a low-frequency word and children could have some difficulties in writing it correctly; "ce n'è" presents a syntactic difficulty because "ce" (autonomous particle with adverbial value) is the homophone and not homograph of the more frequent "c'è" [there is]; "n'è" (i.e., the contracted form of the autonomous particle with adverbial value "ne" + the verb "to be") is the homophone and not homograph of the more frequent "ne" (autonomous particle with adverbial value). So, to write them correctly, children have to understand that the verb "to be" is in the word "n'è" and not in the word "ce." Test–retest reliability of this task is $r = .80$ for the number of words copied and $r = .41$ for the percentage of errors.

Handwriting speed tasks. There are three handwriting speed tasks and they measure the child's graphomotor skills. Each one involves writing as many graphemes as possible in 1 min. The first task consists of writing, without interruptions, the graphemes "le" in cursive (this subtask is the only one in which children have to write in cursive necessarily), one after the other without taking the pen off the paper. The other two tasks consist of writing the word *uno* [one] repeatedly and writing consecutive numbers in letters (i.e., one, two, three . . .), respectively, with the child free to choose the character. For each task, the number of correctly written graphemes is considered as a parameter. The mean test–retest reliability is $r = .83$.

Dictation tasks. There are four dictation tasks: Dictation of words, non-words, texts, and sentences with homophonic, non-homographic words. For the dictation of texts and sentences, short strings of words are dictated without interruption followed by a pause, whereas for the dictation of words and non-words, a pause follows each dictated word.

Dictation of words. This task consists of dictation of 64 words divided into two lists according to their high or low frequency. In addition, half of the words are orthographically regular and the other half present orthographic difficulties.

Dictation of non-words. This task consists of the dictation of two lists of 48 non-words (derived from the syllable combinations of the words used for the dictation of words). The non-words consist of two or three syllables.

Dictation of texts. The battery of dictated texts varies by grade level to reflect the typical texts children encounter at different grade levels. Specifically, the complexity of the dictated texts varies in terms of the number of words, length of words, the average number of words dictated together, number of low-frequency words, and degree of orthographic complexity.

Dictation of sentences with homophonic, non-homographic words. In this case, the child is asked to write 20 dictated sentences containing two strings with the same sound but different orthography, such as "Sul pavimento non c'era la cera" [There was no wax on the floor], where the strings "c'era" [it was] and "cera" [wax] have the same pronunciation in Italian, even if the meaning and orthography are different. The test–retest reliability is high for all tasks ($r = .92$ for dictation of words, $r = .79$ for dictation of non-words, $r = .81$ for dictation of text, and $r = 0.80$ for dictation of sentences with homophonic, non-homographic words).

Expressive writing tasks. There are two expressive writing tasks: description and narration. In the first task, the child has to describe a colored picture (a single picture representing a specific situation), while in the narrative task, the child has to write a story based on colored vignettes (a series of pictures representing a short story). The child has 10 min to complete each task. The objective measures that can be obtained concern spelling (i.e., spelling errors, measured as a percentage, since the texts produced vary in length) and expressive richness, defined by the number of words written. Indeed, previous research (Cornoldi et al., 2022) has shown that unlike other writing tasks where the number of words written is related to handwriting speed, in expressive writing tasks this parameter reflects the ability to produce ideas. Moreover, this measure is closely related to experts' assessment of the quality of texts (Kim et al., 2018; Tressoldi et al., 2012). The mean test–retest reliability for the expressive writing tasks is $r = .65$.

A preliminary analysis for 180 participants showed that there is a high degree of interrater agreement in the scores assigned for all the tasks (Pearson correlations ranged between .915 and 1.00; for more detail, see Table S1 in the online supplemental material).

Procedure

After obtaining approval from the local bio-ethic committee to conduct the study, we obtained permission from the school principals and the children's parents to include the children in the study and organized a meeting with the teachers to plan the testing phase. Trained research assistants (with a psychology degree) then went to each class to administer the entire test battery together with all the students in a single session that lasted approximately 2.5 hr, including three breaks of about 15 min. The research assistants followed a 10-hr training on the administration and correction of the writing tasks with one of the authors of the present article.

Data Analysis

To answer RQ1, concerning the presence of errors also in the copy task and the presence of a particular writing difficulty in the SLD group, we calculated two multivariate analyses of variance (MANOVAs; one for the copy task and another for the other writing tasks) to assess the effects of group (children with TD vs. children with SLD) and grade, and their possible interaction. Because there were different proportions of boys and girls in the groups of children with TD and children with SLD, gender was included as a covariate in these two MANOVAs. To answer RQ2, concerning the possibility of dividing writing skills into three main components (respectively related to handwriting speed, spelling skills, and expressive writing), we computed a factor analysis with principal components extraction and varimax rotation. Finally, to answer RQ3, concerning the predictors of copy abilities in the two groups, we calculated two stepwise linear regression analyses that considered the number of words copied and the percentage of errors in the copy task as the dependent variables, respectively, while the predictors were the factor scores obtained for each dimension extracted from the factor analysis. We analyzed the groups of children with TD and children with SLD separately and compared the similarities and differences between the two regression models.

Results

RQ1: Do Children Also Make Spelling Errors When Copying a Text and Does This Especially Occur for Children With SLD?

The MANOVA for the copy task showed significant effects of both group, $F(2, 721) = 70.77$, $p < .001$, $\eta_p^2 = .164$, and grade, $F(4, 1444) = 11.15$, $p < .001$, $\eta_p^2 = .030$, while there was no interaction effect, $F(4, 1444) = 1.19$, $p = .315$, $\eta_p^2 = .003$. Specifically, the children with TD copied more words and made fewer errors than the children with SLD. The descriptive statistics and significant differences between the groups are shown in Table 2. As can be seen, the group of children diagnosed with SLD copied about 20% fewer words than the children with TD. Moreover, despite the fact that the text was available, spelling errors

Table 2. Means and Standard Deviations for Number of Words Copied and Percentage of Errors for Children With Typical Development (TD) and Children With Specific Learning Disabilities (SLD).

	Children w/ TD		Children w/ SLD				
Task	*M*	*SD*	*M*	*SD*	*F*(1, 722)	*p*	η_p^2
Copy (no. words)	78.15	19.70	61.60	19.85	53.35	<.001	.066
Copy (% errors)	2.28	2.60	6.81	7.20	112.68	<.001	.135

Table 3. Means and Standard Deviations for Other Writing Tasks by Children With Typical Development (TD) and Children With Specific Learning Disabilities (SLD).

	Children w/TD		Children w/SLD				
Tasks	*M*	*SD*	*M*	*SD*	*F*(1, 722)	*p*	η_p^2
Graphemes "le" (# graphemes)	87.02	21.91	74.95	21.23	16.50	<.001	.022
One (# graphemes)	110.97	22.22	107.08	25.15	2.88	.090	.004
Numbers in letters (# graphemes)	127.48	23.81	115.85	25.63	18.66	<.001	.025
Dictation of words (% errors)	5.67	3.49	13.75	8.17	274.81	<.001	.276
Dictation of non-words (% errors)	19.83	10.41	23.49	13.08	7.81	.005	.011
Dictation of text (% errors)	3.26	2.48	8.82	4.79	301.05	<.001	.294
Dictation of phrases (% errors)	2.10	1.91	7.10	4.02	380.94	<.001	.345
Narration (# words)	82.17	23.56	72.87	24.29	6.62	.010	.009
Narration (% errors)	1.85	1.76	7.15	5.27	340.06	<.001	.320
Description (# words)	67.36	28.15	49.77	26.08	19.92	<.001	.027
Description (% errors)	2.01	2.04	8.42	6.33	362.61	<.001	.334

were present in the transcripts and the phenomenon was particularly evident in children with SLD, who made a mean percentage of errors about three times greater than the children with TD. Regarding grade level, there was a linear trend from Grade 6 to Grade 8: The number of words copied increased while the percentage of errors decreased (see online supplemental material, Table S2). Finally, the covariate gender had a significant effect on the percentage of errors, as girls made fewer errors than boys (see online supplemental material, Table S3).

We then conducted a MANOVA on the other writing tasks, which revealed significant effects of both group, $F(11, 712) = 69.42$, $p < .001$, $\eta_p^2 = .517$, and grade, $F(22, 1{,}426) = 10.46$, $p < .001$, $\eta_p^2 = .139$, as well as a significant interaction of group by grade, $F(22, 1{,}426) = 4.75$, $p < .001$, $\eta_p^2 = .068$.

As can be seen in Table 3, the group of children with TD performed better than the children with SLD on all writing tasks, with the exception of the "one" handwriting speed task that required children to write the same word, *uno*, repeatedly.

Regarding grade level, there was a linear trend from Grade 6 to Grade 8: The amount of material produced increased while the percentage of errors decreased (see online supplemental material, Table S4). As for the interaction effect of group by grade, univariate statistics showed that it was significant for the percentage of errors in the words, non-words, texts, and sentences dictation tasks and for the percentage of errors in the narration and description tasks (see online supplemental material, Figure S6). This may be attributed to the fact that the difference between children with TD and children with SLD decreased as they progressed in school, especially in Grade 8. Finally, the covariate gender also had some significant effects: Boys produced fewer "le" graphemes, made more errors in the dictation tasks, and wrote worse texts in the expressive writing tasks (in terms of number of words and percentage of errors) than girls (see online supplemental material, Table S5).

RQ2: Can Writing Skills Be Divided Into Three Main Components: Handwriting Speed, Spelling, and Richness of Expressive Writing?

To find the main dimensions that might play a role in the writing skills of students in Grades 6 to 8, we conducted a factor analysis with principal components extraction and varimax rotation. The rotated matrix is shown in Table 4.

The obtained solution explained a satisfactory percentage of the total variance ($R^2 = 62.99$) and confirmed that the competencies in the different writing tasks can be divided into three main components: Spelling skills

Table 4. Results of the Factor Analysis on the Writing Measures.

	Factors		
Task	1	2	3
Dictation of text (% of errors)	.85		
Dictation of sentences (% of errors)	.84		
Dictation of words (% of errors)	.78		
Dictation of non-words (% of errors)	.74		
Description (% of errors)	.68		
Narration (% of errors)	.48		
Numbers in letters (# graphemes)		.86	
One (# graphemes)		.85	
le (# graphemes)		.69	
Narration (# words)			.80
Description (# words)			.79
Eigenvalue	3.73	1.73	1.48
% of variance	33.88	15.70	13.41

Note. Loads lower than .30 are not reported.

(number of errors in dictated texts, sentences, words, and non-words, and percentage of errors in the description and narrative tasks); handwriting speed ("le," "one," and numbers in letters); and richness of expressive writing (number of words in the narration and description tasks). In addition, the fact that the measures loaded one specific factor and had relatively low loadings on the other factors confirms that the three aspects of writing described by the three factors are largely independent. The first factor, related to spelling accuracy, explained most of the variance and had the highest loadings on measures involving dictation of articulated linguistic material such as texts or sentences. The second factor grouped the handwriting speed tasks, with the lowest loading occurring for the task requiring the use of cursive characters ("le"). Finally, the third factor grouped the richness of expressive writing tasks as measured by the number of words produced.

RQ3: Can the Three Writing Components Predict Copying Ability, and Are the Writing Skills That Predict Copying Performance in Children With SLD the Same as in Children With TD?

Based on the results of the factor analysis, we conducted two stepwise linear regression analyses to examine whether and to what extent the three main aspects of writing (along with gender and grade) predicted the two measures of copying skills (speed and accuracy) in the two groups of children with TD and children with SLD, respectively. We ran two different stepwise linear regression analyses for the two dependent variables referred to as copying ability because the manual reports that they reflect aspects that are not correlated (Cornoldi et al., 2022). In the present study, the correlation between these two variables was actually negative (see Tables S7 and S8 in the online supplemental material).

Moreover, as our sample was rather small in the group of children with SLD ($n = 65$), we performed post hoc power analyses using G*Power 3 (Faul et al., 2007) with an α of .05 to test the effect sizes obtained. The results showed that the power achieved was above .80 (Cohen, 1965) in all analyses (exact values are given with the effect sizes).

In running the stepwise analyses, we first considered the number of words copied as the dependent variable. The stepwise analysis consisted of five steps: In the first step, we considered gender as a predictor, as the previous analyses revealed a significant effect of this variable; in the second step, we also added grade; in the third step, we added handwriting speed, as we hypothesized that this might be the skill most strongly related to the speed of copying a text; in the fourth step, we added spelling skills, as we know from the literature (e.g., Re & Cornoldi, 2015) that the number of words copied also depends on orthographic skills. Finally, in the fifth step, we added the richness of expressive writing, which we assumed to be the least important factor that could influence the speed of copying.

As shown in Table 5, for the children with TD, the most explicative model is the fifth one ($R^2 = .422$; $R^2_{adj} = .418$; power = 1.000), and the best predictors are grade (the older children wrote more words than the younger ones), handwriting speed (the faster writers copied more words than the slower ones), spelling skills (the children who made fewer errors copied more words than the children who made more errors), and richness of expressive writing (the children who wrote longer texts also copied more words than the children who wrote shorter texts). In the group of children

Table 5. Results of Hierarchical Regression Analyses for Variables Predicting Speed in the Copy Task for Children With Typical Development (TD) and the Children With Specific Learning Disabilities (SLD).

		Children with TD				Children with SLD			
Step	Predictor	β	*B*	*SE B*	*t*	β	*B*	*SE B*	*t*
1	Gender	.05	1.83	1.53	1.20	−.19	−7.71	5.15	−1.50
	ΔR^2 and ΔF values	$\Delta R^2 = .002$, $\Delta F(1, 662) = 1.43$, $p = .232$				$\Delta R^2 = .034$, $\Delta F(1, 63) = 2.24$, $p = .140$			
2	Gender	.04	1.44	1.41	1.02	−.16	−6.79	5.14	−1.32
	Grade	.39	9.52	.87	10.98***	.18	4.44	2.98	1.49
	ΔR^2 and ΔF values	$\Delta R^2 = .154$, $\Delta F(1, 661) = 120.52$, $p < .001$				$\Delta R^2 = .033$, $\Delta F(1, 62) = 2.22$, $p = .141$			
3	Gender	.04	1.44	1.21	1.19	−.11	−4.08	4.14	−.99
	Grade	.24	5.89	.78	7.56***	.10	2.32	2.41	.96
	Handwriting speed	.50	9.92	.64	15.49***	.60	10.98	1.84	5.98***
	ΔR^2 and ΔF values	$\Delta R^2 = .225$, $\Delta F(1, 660) = 239.81$, $p < .001$				$\Delta R^2 = .345$, $\Delta F(1, 61) = 35.81$, $p < .001$			
4	Gender	.02	.58	1.19	.49	−.11	−4.60	4.04	−1.14
	Grade	.18	4.26	.82	5.22***	−.02	−.50	2.70	−.18
	Handwriting speed	.53	10.56	.64	16.59***	.60	10.94	1.79	6,13***
	Spelling skills	−.18	−5.54	.98	−5.63***	−.23	−2.80	1.33	−2.10*
	ΔR^2 and ΔF values	$\Delta R^2 = .028$, $\Delta F(1, 659) = 31.64$, $p < .001$				$\Delta R^2 = .040$, $\Delta F(1, 60) = 4.42$, $p = .040$			
5	Gender	.00	.02	1.19	.02	−.11	−4.63	4.08	−1.13
	Grade	.18	4.31	.81	5.34***	−.02	−.45	2.75	−.17
	Handwriting speed	.53	10.60	.63	16.83***	.60	10.94	1.80	6.08***
	Spelling skills	−.20	−6.07	.98	−6.17***	−.23	−2.80	1.35	−2.08*
	Richness of expressive writing	.12	2.37	.61	3.87***	.01	.18	1.70	.11
	ΔR^2 and ΔF values	$\Delta R^2 = .013$, $\Delta F(1, 658) = 15.00$, $p < .001$				$\Delta R^2 = .000$, $\Delta F(1, 59) = .01$, $p = .917$			

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

with SLD, the pattern is partially different, as the fourth model is the most significant ($R^2 = .452$; $R^2_{adj} = .416$; power = 0.983) and the best predictors are handwriting speed (the faster writers copied more words than the slower writers) and spelling skills (the children who made less errors copied more words than the children who made more errors).

We then considered copy accuracy as the dependent variable, which was measured as the percentage of spelling errors made in the copy task. The stepwise analysis consisted of five steps: In the first step, we entered gender as a predictor; in the second step, we added grade; in the third step, we added spelling skills because we hypothesized that this might be the ability most related to accuracy in copying a text; in the fourth step, we added handwriting speed because we assumed that this skill might also play an important role in the accuracy of a copy task; and finally, in the fifth step, we added the richness of expressive writing, which we assumed might be the least important factor affecting accuracy in a copy task.

As shown in Table 6, for the children with TD, the most explicative model is the fifth one ($R^2 = .245$; $R^2_{adj} = .239$; power = 1.000). The significant predictors are gender (girls made fewer errors than boys in copying a text), spelling skills (children with better spelling skills were also more accurate in the copy task), handwriting speed (faster writers made fewer errors than slower writers), and richness of expressive writing (children who wrote longer texts made less errors in the copy task than children who wrote shorter texts). For children with SLD, the third model is the most significant ($R^2 = .268$; $R^2_{adj} = .233$; power = 0.832), and there is only one significant predictor: spelling skills (the children with better spelling skills were also more accurate on the copy task).

Discussion

The ability to copy a text is essential in daily life and in school. Our research, conducted with more than 700 Italian students in Grades 6 to 8, confirmed the importance of assessing this skill when evaluating writing competencies, as this task can provide specific useful information. The first research question of the present study concerned the presence of errors in a copy task and in other writing tasks, especially by children with SLD. The results show that performance in the writing tasks, and in particular in a copy task, was worse for children with SLD than for children with TD. Results concerning the copy task are consistent with previous observations on copying ability (Candela et al., 2012; Parker et al., 2011; Re & Cornoldi, 2015) but provide further, more robust evidence. In particular, they show, as we hypothesized, that children with SLD also have

Table 6. Results of Hierarchical Regression Analyses for Variables Predicting Spelling Accuracy in Copy Task for Children With Typical Development (TD) and Children With Specific Learning Disabilities (SLD).

		Children with TD				Children with SLD			
Step	Predictor	β	*B*	*SE B*	*t*	β	*B*	*SE B*	*t*
1	Gender	−.17	−.91	.20	−4.54***	−.14	−2.15	1.88	−1.14
	ΔR^2 and ΔF values	ΔR^2= .030, $\Delta F(1, 662) = 20.62$, $p < .001$				$\Delta R^2 = .020$, $\Delta F(1, 63) = 1.31$, $p = .257$			
2	Gender	−.17	−.88	.20	−4.50***	−.16	−2.41	1.89	−1.28
	Grade	−.21	−.66	.12	−5.46***	−.14	−1.26	1.09	−1.15
	ΔR^2 and ΔF values	$\Delta R^2 = .042$, $\Delta F(1, 661) = 29.84$, $p < .001$				$\Delta R^2 = .020$, $\Delta F(1, 62) = 1.32$, $p = .255$			
3	Gender	−.12	−.65	.18	−3.52***	−.13	−1.98	1.67	−1.19
	Grade	−.09	−.05	.12	−2.31*	.13	1.17	1.11	1.06
	Spelling skills	.38	1.15	.15	10.19***	.55	2.42	.55	4.36***
	ΔR^2 and ΔF values	ΔR^2= .126, $\Delta F(1,660) = 103.80$, $p < .001$				$\Delta R^2 = .228$, $\Delta F(1, 61) = 19.02$, $p < .001$			
4	Gender	−.12	−.62	.18	−3.47**	−.14	−2.04	1.69	−1.21
	Grade	−.02	−.05	.12	−.43	.14	1.22	1.13	1.08
	Spelling skills	.41	1.65	.15	11.16***	.55	2.42	.56	4.33***
	Handwriting speed	−.19	−.50	.10	−5.24***	−.04	−.27	.75	−.36
	ΔR^2 and ΔF values	ΔR^2= .032, $\Delta F(1, 659) = 27.43$, $p < .001$				$\Delta R^2 = .002$, $\Delta F(1, 60) = .13$, $p = .724$			
5	Gender	−.11	−.55	.18	−3.04**	−.13	−1.96	1.71	−1.15
	Grade	−.02	−.06	.12	−.50	.13	1.13	1.15	.98
	Spelling skills	.43	1.73	.15	11.64***	.55	2.42	.56	4.30***
	Handwriting speed	−.19	−.51	.10	−5.35***	−.04	−.27	.75	−.35
	Richness of expressive writing	−.12	−.33	.10	−3.57***	−.07	−.42	.71	−.59
	ΔR^2 and ΔF values	$\Delta R^2 = .015$, $\Delta F(1, 658) = 12.77$, $p < .001$				$\Delta R^2 = .004$, $\Delta F(1, 59) = .35$, p= .558			

*$p \leq .05$. **$p \leq .01$. ***$p \leq .001$.

difficulty in copying a text, although they have the text available and could potentially control the correctness of their writing. This difficulty cannot be attributed to a speed-accuracy trade-off (i.e., to the fact that the children with SLD were in a hurry and wanted to save time) because results indicate that they were slower than the children with TD.

The other writing tasks administered in this study varied according to the material and type of request and focused on different writing processes. In general, children with SLD performed significantly worse than children with TD with the exception of the "one" handwriting speed task that was probably too simple and therefore poorly discriminative. However, this task reflected the same ability as the other two handwriting speed tasks, as suggested by the results concerning our second research question, whether the writing skills could be divided into three main components. Indeed, the results of the factor analysis confirmed that basic writing skills can be divided into the three predicted components, although part of it remained unexplained, suggesting that, with a larger variety of measures, a more complete articulation of writing skills could be found. The three components were spelling skills (percentages of errors in different forms of dictation and in expressive writing tasks), handwriting speed (numbers of letters written when writing "le," "one," numbers in letters), and richness of expressive writing (number of words in expressive writing tasks), as observed in other languages (García et al., 2017; Yan et al., 2012). Most of the variance was explained by the spelling factor. As it was possible to measure spelling skills also from the texts produced by the child, we had six measurements of spelling skills, that is, a higher number of measurements than for the other aspects of basic writing skills. It is interesting that the highest loading on this factor was observed for text dictation, which requires not only the correct orthographic representation of different words (as in word dictation) but also the segmentation of the text into words including all possible forms of linguistic material (e.g., pronouns, prepositions, articles). On the contrary, the lowest loading on the spelling dimension was found for the percentage of errors in the narration task, probably because the child, having the possibility of choosing the words, decided to use simple and familiar words. The handwriting speed factor had the highest loadings for the two measures where the child could choose the character (e.g., block writing vs. cursive writing, either in capitals or in small letters), while the loading was lower for the task that required the use of cursive writing, a character typically (but not necessarily) used by Italian students. In fact, the mean number of written letters was lowest when children had to use cursive,

suggesting that this character was less familiar to many of them and reflected to a lesser extent their typical handwriting skills. On the contrary, the highest number of graphemes was written when they were asked to use the preferred character for writing consecutive numbers in letters. Regarding the latter task, it should be pointed out that although it requires spelling skills (and indeed differentiated better between children with TD and children with SLD than the tasks requiring always writing the same word), it was also associated with the highest number of letters written, suggesting that repetition slows handwriting. Loading on the third factor were tests that measured the richness of text production in terms of the number of words in describing a picture or in telling a story using vignettes. Both tasks had high and similar loadings, probably because both involve similar higher order cognitive processes such as planning and idea generation and also draw on general knowledge about the world. These higher order processes are not involved in spelling and handwriting speed.

The third research question concerned the extent to which the three basic writing components—handwriting speed, spelling, and expressive writing—can predict performance in copying and whether the predictors are the same for children with SLD and children with TD. Our results showed that in the group of children with TD speed in copying was predicted by grade level, handwriting speed, spelling skills, and richness of expressive writing. That is, older children, children with better graphomotor skills, children who made fewer spelling errors, and children who showed higher expressive writing productivity copied the text faster. In contrast, copying speed in children with SLD was predicted only by handwriting speed and spelling skills, suggesting that these children are not able to take advantage of all aspects of writing to improve this skill. These data are consistent with previous research (Arfè et al., 2020; Kandel & Perret, 2015; Lambert et al., 2011) that used the copy task to examine the relationship between spelling skills and speed in children with SLD and found a strong relationship between these two aspects. In addition, grade level was not a significant predictor for children with SLD, indicating that in this group, speed in copying a text does not improve significantly with schooling, at least not for the grade levels studied. We found that for children with TD, copying accuracy is predicted by all measured basic writing skills and by gender (girls made fewer errors than boys), while the grade is not a significant predictor. Descriptive statistics suggest that this can be explained by the very low number of spelling errors made by children with TD in these grades. Instead, even in the case of copying accuracy, there was a smaller number of significant predictors for the children with SLD, in this case only the spelling skills. To sum up, the results of the regression analyses indicate that children with TD benefit from all different types of writing skills, in terms of both speed and accuracy in a copy task, while this is not the case for children with SLD. For these children, we found instead a different pattern of predictors of copy speed and accuracy: The first was predicted by handwriting speed and spelling skills, and the second by spelling skills only. These differences between groups could be due in part to a generally lower level of writing experience for students with SLD, related not only to their difficulty but also to instructional strategies and requests that could lead to less practiced and less developed copying skills. However, it should be noted that in Italy children with SLD attend the same classes and go through the same programs as children with TD and they also receive out-of-school writing treatments to improve their skills. Thus, it is unlikely that the differences we found between children with SLD and children with TD can be explained by fewer writing experiences. Rather, it is possible that teachers' lack of attention to copying instructions affects performance, especially for children with SLD. In addition, general deficits underlying writing difficulties, such as in working memory, attention, and processing speed (Toffalini et al., 2017), or specific deficits underlying copying, such as in self-regulation, motor skills, and reading (Cornoldi et al., 2022), may also affect performance. We hope that the present study will stimulate future ones that examine the present questions with a broader battery of tasks that incorporate writing and related skills, providing a more complete description of the phenomena examined here.

Conclusion

Our results provide important new information about copy skills, especially for children with SLD, whose performance is poorer and influenced differently by other basic writing skills than in children with TD. This study also has some limitations, however. The first concerns the difference in the size of the two groups (although it should be noted that the R^2 values in the regression analyses for both speed and accuracy in the copy task were similar for the two groups and the power of our analyses reached sufficient levels). Another limitation is the fact that our children with SLD consisted of a relatively heterogeneous group with different learning problems in reading, writing, or arithmetic. However, this heterogeneity is in line with the new definition of SLDs in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* that considers SLD as a unique disorder with different specific learning impairments (American Psychiatric Association, 2013). Although our results showed that all children with SLD had low performance in writing, in future studies, it would be interesting to compare children with specific impairments in different learning domains, especially in reading and writing, with matched children with TD on a copy task. Finally, the study only examined the influence on copying of other writing skills without considering and obtaining measures

for other variables that presumably affect copying performance (e.g., working memory or motor abilities).

Despite these limitations, we believe this study offers important educational and clinical implications. First, our results suggest that the task of copying a text is discriminative and could therefore be a good alternative or additional task in the assessment of writing skills, as it allows for distinguishing children with problems in this area from those without. In fact, usually the most commonly used writing tasks to assess writing skills involve dictation of words, sentences, or texts. However, dictation, when assessing the child's writing competences, can be influenced by factors such as the tone of the person dictating and the speed of dictation, among others. Another task typically used to assess writing skills is expressive writing, which may present other limitations: (a) children may choose to write the text using simple words and (b) expressive writing involves several cognitive processes such as planning, idea production, and revision that may affect spelling performance. To avoid these problems in assessing writing skills, the use of a copy task might be a valid alternative.

Second, our results suggest that specific activities should be proposed to children to improve their copying skills. In this regard, we would like to emphasize that grade was not a predictor of either copying speed or accuracy for the children with SLD. This means that children with SLD who are attending middle school do not improve their performance spontaneously (i.e., following the typical school program) unless we specifically address the copying difficulty. However, practitioners should be cautious in deciding the type of intervention as there is evidence that training of some specific abilities underlying copying (e.g., visuomotor abilities) may not produce improvement in academic performance. Presumably, intervention should be mainly focused on the copying ability per se, helping children to recognize their difficulties and teaching specific strategies as has been successfully done for other aspects of writing (see, e.g., Re et al., 2008). This suggestion is further supported by the fact that the present study shows that children with SLD are affected by their spelling abilities when copying and do not take advantage of their handwriting, and especially expressive writing, abilities.

The importance of copying skills requires new attention from researchers, practitioners, and teachers. The present results indicate that this should be of particular benefit to children with SLD.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

ORCID iDs

Anna Maria Re https://orcid.org/0000-0002-6420-1923
Susanna Schmidt https://orcid.org/0000-0001-7505-0676

Supplemental Material

Supplemental material for this article is available on the *Journal of Learning Disabilities* website with the online version of this article.

References

Adi-Jafa, E., Landau, Y. E., Frenke, L., Teicher, M., Gross-Tsur, V., & Shalev, R. S. (2007). ADHD and dysgraphia: Underlying mechanisms. *Cortex*, *43*, 700–709. https://doi.org/10.1016/S0010-9452(08)70499-4

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). https://doi.org/10.1176/appi.books.9780890425596

Arfè, B., Corato, F., Pizzocaro, E., & Merella, A. (2020). The effects of script and orthographic complexity on the handwriting and spelling performance of children with dyslexia. *Journal of Learning Disabilities*, *53*(2), 96–108. https://doi.org/10.1177/0022219419892845

Candela, M., Re, A. M., & Cornoldi, C. (2012). L'utilità di una prova di copia per individuare problemi di disortografia [The advantages of a copy task for the individuation of spelling problems]. *Dislessia*, *9*(3), 363–374.

Cohen, J. (1965). Some statistical issues in psychological research. In B. B. Wolman (Ed.), *Handbook of clinical psychology* (pp. 95–121). McGraw-Hill.

Cornoldi, C., Del Prete, F., Gallani, A., Sella, F., & Re, A. M. (2010). Components affecting expressive writing in typical and disabled writers. *Advances in Learning and Behavioral Disabilities*, *23*, 269–286. https://doi.org/10.1108/S0735-004X(2010)0000023012

Cornoldi, C., Ferrara, R., & Re, A. M. (2022). *BVSCO-3 Batteria per la Valutazione clinica della Scrittura e della Competenza Ortografica–3* [BVSCO-3, Battery for the assessment of writing and spelling accuracy]. Giunti Psychometrics.

Di Brina, C., Averna, R., Rampoldi, P., Rossetti, S., & Penge, R. (2018). Reading and writing skills in children with specific learning disabilities with and without developmental coordination disorder. *Motor Control*, *22*(4), 391–405. https://doi.org/10.1123/mc.2016-0006

dos Santos, N. L., Cardoso, M. H., & Capellini, S. A. (2021). A velocidade e legibilidade da escrita manual de disléxicos em tarefas de cópia [Speed and legibility of manual writing among dyslexic children in copy task]. *Disturbios da Cominicação*, *33*(2), 315–321. https://doi.org/10.23925/2176-2724.2021v33i2p315-321

Dovigo, V., & Re, A. M. (2013). Errori di ortografia di bambini a rischio ADHD e a sviluppo tipico in un compito di copia e di dettato [Spelling errors in children with ADHD and with typical development in a copy task and in dictation]. *Psicologia Clinica dello Sviluppo*, *XVII*, 511–520. https://doi.org/10.1449/76232

Faul, F., Erdfelder, E., Lang, A.-G., & Buchner, A. (2007). G*Power 3: A flexible statistical power analysis program

for the social, behavioral, and biomedical sciences. *Behavior Research Methods*, *39*(2), 175–191. https://doi.org/10.3758/BF03193146

García, E., Crespo, P., & Bermúdez, I. (2017). Writing an independently composed sentence by Spanish-speaking children with and without poor transcription skills: A writing-level match design. *Journal of Learning Disabilities*, *50*(5), 511–521. https://doi.org/10.1177/0022219416633862

Haslum, M. N., & Miles, T. R. (2007). Motor performance and dyslexia in a national cohort of 10-year-old children. *Dyslexia*, *13*(4), 257–275. https://doi.org/10.1002/dys.350

Istituto Superiore di Sanità [Italian National Institute of Health]. (2011). *Consensus Conference: Disturbi Specifici dell'Apprendimento* [National Consensus Conference on Specific Learning Disabilities], Roma, Italy. https://www.liceomascheroni.it/wp-content/uploads/2016/04/Consensus-Conference-3.pdf

Kandel, S., & Perret, C. (2015). How does the interaction between spelling and motor processes build up during writing acquisition? *Cognition*, *136*, 325–336. https://doi.org/10.1016/j.cognition.2014.11.014

Kim, Y. S. G., Gatlin, B., Al Otaiba, S., & Wanzek, J. (2018). Theorization and an empirical investigation of the component-based and developmental text writing fluency construct. *Journal of Learning Disabilities*, *51*(4), 320–335. https://doi.org/10.1177/0022219417712016

Lambert, E., Alamargot, D., Larocque, D., & Caporossi, G. (2011). Dynamics of the spelling process during a copy task: Effects of regularity and frequency. *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale*, *65*(3), 141–150. https://doi.org/10.1037/a0022538

Law 170/2010. (2010, October 10). *Nuove norme in materia di disturbi specifici di apprendimento in ambito scolastico* [New legal standards on learning disabilities at school] (GU General series no. 244). Government Gazzette. https://www.gazzettaufficiale.it/eli/id/2010/10/18/010G0192/sg

Parker, D. C., McMaster, K. L., Medhanie, A., & Silberglitt, B. (2011). Modeling early writing growth with curriculum-based measures. *School Psychology Quarterly*, *26*(4), 290–304. https://doi.org/10.1037/a0026833

Re, A. M., Caeran, M., & Cornoldi, C. (2008). Improving expressive writing skills of children rated for ADHD symptoms. *Journal of Learning Disabilities*, *41*(6), 535–544. https://doi.org/10.1177/0022219408317857

Re, A. M., & Cornoldi, C. (2015). Spelling errors in text copying by children with dyslexia and ADHD symptoms. *Journal of Learning Disabilities*, *48*(1), 73–82. https://doi.org/10.1177/0022219413491287

Re, A. M., Pedron, M., & Cornoldi, C. (2007). Expressive writing difficulties in children described as exhibiting ADHD symptoms. *Journal of Learning Disabilities*, *40*(3), 244–255. https://doi.org/10.1177/00222194070400030501

Toffalini, E., Giofrè, D., & Cornoldi, C. (2017). Strengths and weaknesses in the intellectual profile of different subtypes of specific learning disorder. *Clinical Psychological Science*, *5*, 402–409. https://doi.org/10.1177/2167702616672038

Tressoldi, P. E., Cornoldi, C., & Re, A. M. (2012). *BVSCO-2 Batteria per la Valutazione della Scrittura e della Competenza Ortografica nella scuola dell'obbligo*. [BVSCO-2, Battery for the assessment of writing and spelling accuracy]. Giunti OS.

Yan, C. M. W., McBride-Chang, C., Wagner, R. K., Zhang, J., Wong, A. M., & Shu, H. (2012). Writing quality in Chinese children: Speed and fluency matter. *Reading and Writing*, *25*(7), 1499–1521. https://doi.org/10.1007/s11145-011-9330-y