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Writing abilities in intellectual disabilities: A comparison between Down and Williams syndrome

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ABSTRACT

Writing is a complex task that requires the integration of multiple cognitive, linguistic, and motor abilities. Until now, only a few studies investigated writing abilities in individuals with Intellectual Disability (ID). The aim of the present exploratory study was to provide knowledge on the organization of writing in two populations with ID, Down syndrome (DS) and Williams syndrome (WS), trying to disentangle different components of the process.

A battery tapping diverse writing demands as low-level transcription skills as well as high-level writing skills was proposed to 13 individuals with WS, 12 individuals with DS and 11 mental-age-matched typically developing (TD) children.

Results showed that the two groups with genetic syndromes did not differ from TD in writing a list of objects placed in bedroom, in the number of errors in the text composition, in a text copying task and in kind of errors made. However, in a word dictation task, individuals with DS made more errors than individuals with WS and TD children. In a pseudoword dictation task, both individuals with DS and WS showed more errors than TD children.

Our results showed good abilities in individuals with ID in different aspects of writing, involving not only low-level transcription skills but also high-level composition skills.

Contrary to the pessimistic view, considering individuals with ID vulnerable for failure, our results indicate that the presence of ID does not prevent the achievement of writing skills.

1. Introduction

Writing is a complex task that requires the integration of multiple cognitive, linguistic, and motor abilities.

Writing involves both low-level transcription skills (e.g. handwriting) as well as high-level composition skills (e.g. planning and revision). Specifically, three distinct language levels have been pointed out in writing (Wendling & Mather, 2009): letter formation (handwriting), word formation (spelling), and text formation (composition).

The evolution of writing (Frith, 1985) begins with an early *logographic phase* in which child uses the word as a picture. Children's writing then evolves toward the *alphabetic* principle, where the child learns the relationship between verbal and

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written form of words. In this phase is activated the conversation phoneme–grapheme. Then the *orthographic phase* appears while the main regularities and the most frequent irregularities are taken into account. Finally, in the *lexical phase* the child create a lexical storehouse and retrieve directly the words. At this point, the activity of writing has become automatic and fast. The child is still able to use the mode of the previous stages, for example, to write new words, which does not know the meaning, or writing words meaningless (pseudowords). In essence, the complete acquisition of the first three phases takes place through phonological way. While, the achievement of the fourth stage (lexical) allows the child to properly use the lexical way and write known words without phoneme-to-grapheme conversion.

To date it is unclear which level of writing skill children with Intellectual Disability (ID) attain. The broad heterogeneity, combined with all sorts of other variables influencing their learning and development, such as extremely varied socio-cultural family backgrounds or further medical diagnoses, does not allow establishing how many students with ID read or write at all or the writing level achieved (Dworschak, Kannewischer, Ratz, & Wagner, 2012).

Recent data derived from the study by Ratz and Lenhard (2013) investigating reading and writing stages of 1629 school-aged students with ID regardless of etiology (age 6–21) in Bavaria. Results documented that about a third of the students with ID did not read or write at all. The alphabetic and orthographic stages in reading were each achieved by a third of the students with ID (alphabetic = 31.9%; orthographic = 32.0%). The number of students with ID writing at a logographic stage was higher (16.9%) than the orthographic stage (13.5%). More than one third reached the alphabetic level (37%).

By studying genetic syndromes causing ID we can limit the phenotypic high heterogeneity and clarify how specific genotypes can affect complex processes, as academic skills.

Down syndrome (DS) or Williams syndrome (WS) are two genetic disorders that are both characterized by ID and that are often compared in literature to better understand if a neuropsychological deficit is just a consequence of ID or, alternatively, it is syndrome-specific (Vicari et al., 2004). The well documented neuropsychological profile is characterized for individuals with WS by a relative strength in language skills, but weakness in visuo-spatial skills. However, individuals with DS show more reduced language expressive abilities in phonology and syntax than visuo-spatial skills (e.g. Kent & Vorperian, 2013; Martin, Klusek, Estigarribia, & Roberts, 2009; Vicari, Bellucci, & Carlesimo, 2001).

While some data are available in reading in individuals with DS and WS, there is very little information available on writing (Conners, Moore, Loveall, & Merrill, 2011; Menghini, Verucci, & Vicari, 2004; Verucci, Menghini, & Vicari, 2006).

1.1. Reading and writing in DS

There is evidence found that shows that many individuals with DS learn to read (Bochner, Outhred, & Pieterse, 2001) although children with DS need exposure to academic activities of about three or four years longer than typically developing (TD) children (Vianello, 2006). Actually, in only a few cases, children with DS younger than 9 years were able to read and write at a level of the first grade. However, students with DS attending secondary school showed a reading and writing level two years higher than children of the same mental age (MA) (Sestili, Moalli, & Vianello, 2006). Moreover, writing skills in DS are lower than those in reading and only slightly higher than expected on the basis of MA (about one year) (Vianello, 2006).

Regarding reading abilities, more studies (Boudreau, 2002; Buckley, 1985; Hulme et al., 2012; Laws & Gunn, 2002) identified that reading accuracy in DS is a relative strength area in comparison to general cognitive ability and reading comprehension. While word reading is generally preserved (Boudreau, 2002; Roch & Jarrold, 2008; Verucci et al., 2006), pseudoword reading is compromised, probably due to their poor phonological awareness (Lemons & Fuchs, 2010; Næss, Melby-Lerva, Hulme, & Lyster, 2012; Steele, Scerif, Cornish, & Karmiloff-Smith, 2013). Difficulties in pseudoword reading and in phonological awareness and preserved abilities in word reading suggest individuals with DS recruit compensatory strategies to read words as lexical strategy or lexical access to read the word (Boudreau, 2002; Buckley, 1985; Hulme et al., 2012; Kay Raining Bird, Cleave, White, Pike, & Helmkay, 2008; Mengoni, Nash, & Hulme, 2014).

As previously said, only a few non-systematic study has been conducted on writing abilities in DS (Kay Raining Bird et al., 2008; Lavra-Pinto & Lamprecht, 2010). Although a significant positive association between syllabic phonological awareness and writing abilities in individuals with DS was observed (Lavra-Pinto & Lamprecht, 2010), phonemic awareness seemed to emerge only when written skills were acquired (Cardoso Martins & Frith, 2001). However, vocabulary comprehension was found the best predictor for written narrative skills in individuals with DS, underlining the importance of the connection between vocabulary and literacy (Kay Raining Bird et al., 2008). Moreover, in writing, individuals with DS made more orthographic errors than TD children matched for reading a level (Kay Raining Bird et al., 2008). Concerning handwriting abilities, difficulties were found in adults with DS compared with TD individuals matched for chronological age (CA) and interpreted as a difficult in controlling the movement chain necessary to the process of writing (Tsao, Fartoukh, & Barbier, 2011).

1.2. Reading and writing in WS

Reading skills in adolescents with WS have been reported as strong relative to IQ (Pagon, Bennett, LaVeck, Stewart, & Johnson, 1987). However, a large-scale study with adults identified relatively low reading plateaus (Howlin, Davies, & Udwin, 1998), and a longitudinal study reported little or no reading improvement between adolescence and adulthood (Udwin, Howlin, Davies, & Mannion, 1998). When individuals with WS were compared to a group of TD children matched for MA, particular difficulties in reading were found in passage comprehension and in pseudoword reading (Menghini et al., 2004) while word and text reading seemed to be more preserved.

Concerning precursors to reading (phonological awareness), results of studies were inconclusive and discordant. For example, the study by Steele et al. (2013) documented that children with WS had better vocabulary, rhyme and phoneme matching abilities than nonverbal MA controls and children with DS. Similarly, phonological skills were found equivalent to TD controls matched for reading age (RA) and verbal MA, with no significant differences in syllable or phoneme identification, or rhyme detection/production in the study by Laing, Hulme, Grant and Karmiloff-Smith (2001). Moreover, in the same study correlations were found between reading and phonological abilities in both groups, although weaker in WS after controlling for cognitive abilities (Laing et al., 2001).

Conversely, the study by Majerus, Barisnikov, Vuillemin, Poncelet and van der Linden (2003) documented weak phonological processing skills in four 10- to 12-year olds with WS and also in the study by Menghini et al. (2004), individuals with WS were impaired in syllable deletion and rhyme detection compared to MA matched controls.

Regarding writing in WS, to date only handwriting abilities were systematically analyzed (Nakamura et al., 2009) and found impaired in individuals with WS compared to CA-matched controls.

The aim of the present exploratory study was to provide knowledge on the organization of a complex cognitive process, as writing, trying to disentangle the different components of the process in two populations with ID. The study of different genetic syndromes characterized by ID may provide useful information for understanding if writing deficits are just a consequence of ID or, conversely, are syndrome-specific and also people with ID can show some preserved aspects. If writing abilities are not dependent from the IQ level and are more related to the specific genetic alteration determined by the syndrome, our results will show differences between groups with WS and DS. On the contrary, if writing is independent from etiology and more likely linked to ID severity, then individuals with WS and DS will present comparable abilities.

To study in detail writing abilities in individual with ID, participants with DS and WS matched for IQ and CA were included in the study. Participants with ID were compared to a group of TD younger children matched for cognitive level and with similar word RA to verify if writing abilities are those expected for their MA and RA.

We investigated both low-level transcription skills (as handwriting) as well as high-level composition skills (as text writing). Moreover, to identify which stage of writing skill children with ID attain we examined the knowledge of alphabetic principle and of the phoneme–grapheme conversation, particularly involved in pseudoword writing, but also orthographic and lexical abilities, required for word and text writing.

Since in reading both groups showed more difficulties with pseudowords than with words, we expected also in writing better abilities with words than with pseudowords. However, due to their phonological difficulties in expressive language we predicted more difficult in writing pseudowords in DS and more phonological errors in this group than in WS. Conversely, since WS individuals show deficits in visuo-spatial skills, in handwriting we expected more difficult in WS than in DS group.

Most of the few studies on writing in ID investigated this ability in relatively complex orthographies like English. Unlike English, Italian is characterized by relatively simple (i.e. transparent) relationships between orthography and phonology. Therefore, choosing the correct graphemes in words in Italian is fairly simple and the reading and writing acquisition is a lot quicker in Italian than in English (Perry, Ziegler, & Zorzi, 2014). Therefore, in comparison to the few pessimistic data in literature on writing in English, we expect that our participants with ID will achieve writing skills.

2. Participants and methods

2.1. Participants

From a group of 15 participants with DS and 15 with WS, 12 individuals with DS and 13 with WS were recruited for the study since were able to write their first name and surname.

Participants with WS and DS were part of a larger pool of individuals attending the Children's Hospital Bambino Gesù of Rome, for a clinical and rehabilitative follow up. All of WS participants exhibited: a diagnosis established by FISH analysis; the absence of neurosensory deficits, such as hypoacusia or serious visual impairment; the absence of epilepsy and psychopathological disorders. For all participants with DS were documented: a free trisomy 21; the absence of any neurosensory deficits, such as hypoacusia or serious impairment of virus; and absence of epilepsy and psychopathological disorders. All participants lived with their own families. Observations were carried out after informed consent had been obtained from all participants and their families.

The two groups were well matched on CA ([$F(1,23) = 0.009$, $p = .92$) and on IQ ([$F(1,23) = 0.07$, $p = .78$), according to Mervis and Klein-Tasman (2004) criteria that indicated a p value greater than .50 large enough for considering groups matched.

IQ was assessed by means of the Leiter International Performance Scale – Revised, brief version (Leiter–R, Roid & Miller, 2002) or by means of the Raven's Coloured Progressive Matrices (Raven, 2008).

All participants carried out a rehabilitation program as provided by the Italian guidelines on ID. In particular children with ID, generally when they are three years old, begin a rehabilitation program psychomotor and speech therapy to improve motor and linguistic skills. When they start primary school the treatment become target to improve learning abilities (reading, writing and mathematics).

For the two clinical groups the RA was calculated by means of a word reading task taken from the Italian battery for evaluating dyslexia and dysorthography (Sartori, Job, & Tressoldi, 2007). Participants were asked to read aloud four lists of 112 regular isolated words and the number of errors was scored. The word reading accuracy both within 1SD below or above normative data of a particular age was considered as measure of RA. Since the RA of both groups with ID was 7 years, 11 TD

children (five female) were selected from the second grade class and matched to the groups with ID for MA [$F(2,33) = 1.1$, $p = .32$), see Table 1. Due to the positive relationship between reading abilities and writing abilities (Singson et al., 2000), in addition to the criterion of MA, the level of education based on word RA was considered to select the TD group so that possible differences in writing skills between participants with ID and TD children could not be ascribed to differences in reading.

2.2. Materials: evaluation of writing abilities

2.2.1. List of object

The task consist of writing a list of objects placed in the bedroom on a paper sheet. The errors/words rate was calculated.

2.2.2. Dictation

Two dictation tasks from the Battery for Evaluating Dyslexia and Dysorthography edited by Sartori et al. (2007) were proposed. In particular 16 words selected from a list of 112 isolated regular words, equally divided between high and low estimated frequency of occurrence and 16 pseudowords selected from a list of 48 isolated pseudowords with graded difficulty. The pseudoword list was composed by using existent syllables with a plausible structure, similar to real words (e.g. *cinama, vugherzo* are pseudowords with high word-likeness). The participants have to write the words and pseudowords read by the examiner. The number of errors and the kind of error was analyzed. Errors belong to three categories: phonological, visual and orthographic errors. Phonological errors were classified as replacement of letters with similar sound (*f*/*v*, *c*/*g*, *d*/*t*). Visual errors were considered as substitutions of letters with similar or specular visual trait (*a*/*e*, *b*/*d*, *d*/*b*, *p*/*q*, *q*/*p*, *a*/*o*). Finally, for orthographic knowledge errors were referred to the application of orthographic rules for writing correctly the word as the use of double letters or of "nonphonetic" sounds (e.g. *sch, sc, gn, gl*).

Errors could not be unambiguously assigned to a category were not classified and excluded from the analysis. For instance, the substitution *b*/*p* that is both a phonological and a visual error; the substitution *e*/*o*, *u*/*o* that does not fit in any category of errors.

2.2.3. Brief text composition

A brief text composition task based on six simple sequenced illustrated pictures was then adopted. The pictures tell the story of a boy who buys a balloon and cries afterwards because it blows away. After viewing pictures children were asked to expose orally the story and then to write it. Before writing, participants were asked for orally telling the story to verify they were able to describe the sequences. In the brief text composition were evaluated the words/episodes rate, errors/words rate, the kind of error (orthographic or syntactic), and the presence of logical links. The entire text was considered logically linked (the score given was 1) when every sequence was the consequence of the previous one, except for the first sequence which was the initial cause of all subsequent sequences. The presence of logical link was coded by two independent raters, CV and DM (Intraclass Correlation Coefficient = .95).

2.2.4. Text copying

In the copying task participants have to copy a written story. The number of errors, time spent and qualitative aspects of handwriting were evaluated (Pratelli, 1995). As parameters of handwriting were considered: the *orientation* (positioning) in graphic space (i.e. if the child respected the border of the sheet; if he left regular spaces between graphemes and words and if he followed the line of writing. The score was 3 if all three parameters were present, 2 if two, and 1 if one); the *pressure* applied to the paper with the pencil when writing is appropriate (i.e. either not too heavy or too light. The score was 1 if the pressure was appropriate); the *size* of the letters was appropriate (i.e. not too small or too big. The score was 1 if the size was appropriate). Two independent raters, CV and DM, evaluated handwriting parameters (Intraclass Correlation Coefficient = .92).

2.3. Procedure

Participants were evaluated individually in one testing session. The evaluation lasted approximately 1 h and a half with a pause of about one hour. The task order was randomized. For each task, the experimenter verified that the participant

Table 1
Demographic data and reading measures of participants with WS and DS participants.

	WS (13)	DS (12)	TD (11)
Sex F/M	6/7	9/3	5/6
CA mean (range)	19.7(13–29)	19.5(7–31)	7.7 (6.1–7.3)
MA mean (range)	7.3(5–10)	5.9(4.8–7.8)	6.7 (5.5–7.5)
IQ mean (range)	50.1 (36–76)	48 (32–83)	101 (90–110)
Word reading accuracy mean ± SD	100.6 ± 10.8	99.6 ± 9	104.4 ± 2.5
Word reading accuracy age (yrs)	7	7	7

WS = Williams syndrome; DS = Down syndrome; TD = typical development; F/M = female/male; SD = standard deviation; yrs = years.

understood the instructions. All of the tasks included a practice phase during which the experimenter illustrated the task instructions.

2.4. Statistical analysis

Data were analyzed using the Statistical Program for Windows, Version 8.0 (StatSoft, Inc., Tulsa, OK, USA).

One-way Multivariate Analysis of Variance (MANOVA) was conducted on the following dependent variables: the rate errors/words for the list of objects, the rate errors/times for the text copying task, the errors for the word dictation task and for the pseudoword dictation task, the rate words/episodes and the rate errors/words for the text Composition task.

Post hoc analyses were performed by means of Fisher LSD.

Cohen's d (d) and partial eta-squared (η^2) have been reported as effect size measures.

The presence of logical links, handwriting measures and the kinds of errors for words, pseudowords, and text composition were analyzed by using chi square test.

Significant differences were considered for $p < .05$.

3. Results

Table 2 showed mean and standard deviation of each group for the writing measures adopted in the study and post hoc summary of group comparisons.

The results of the MANOVA were significant for the Group effect [$F(2,33) = 7.21$, $p = .0025$, partial $\eta^2 = .3$], since participants with DS showed a lower mean scores than participants with WS ($p = .038$) and TD children ($p = .006$). Also the Task effect [$F(5,165) = 64.25$, $p < .0001$, partial $\eta^2 = .7$) was found significant and the interaction Group × Task [$F(10,165) = 4.61$, $p = 00001$, partial $\eta^2 = 2$).

Post hoc analyses documented groups did not differ (all $p > .1$) in writing the list of objects placed in bedroom (errors/words rate), in the text composition task (words/episodes rate and errors/words rate) and in the text copying task (errors/times rate).

However, groups differed in the dictations tasks. Participants with DS made more errors in the word dictation task than WS and TD children (WS vs DS, $p = .005$, $d = .8$; TD vs DS, $p = .0016$, $d = 1$) while WS and TD children did not differ in the

Table 2
Means (SD) of each group and comparisons between groups (post hoc summary) for each Writing Measure considered.

Task	WS Mean (SD)	DS Mean (SD)	TD Mean (SD)	Post hoc summary
List of objects				
Errors/words	0.2 (0.3)	0.3 (0.1)	0.2 (0.2)	DS = WS = TD
Dictation				
Words				
Errors	2.9 (3.6)	5.5 (4.1)	2.4 (1.2)	DS < WS=TD
Kind of errors				
Phonological	1.6 (2.1)	1.8 (1.5)	1 (1.1)	DS = WS = TD
Visual	0.1 (0.2)	0.1 (0.3)	0.1 (0.3)	DS = WS = TD
Orthographic	1.8 (1.6)	3.7 (3.2)	1.1 (0.8)	DS = WS = TD
Pseudowords				
Errors	6.23 (3.56)	10.17 (6.12)	3.45 (2.46)	DS < WS < TD
Kind of errors				
Phonological	4.6 (2.9)	5 (4.7)	2.2 (2.3)	DS = WS = TD
Visual	0.3 (0.8)	0.5 (1)	0 (0)	DS = WS = TD
Orthographic	1 (0.7)	4.5 (3.5)	1.1 (1)	DS = WS = TD
Text composition				
Words/episodes	6.5 (1.2)	5.7 (2.5)	4.9 (0.7)	DS = WS = TD
Errors/words	0.2 (0.1)	0.3 (0.2)	0.1 (0.1)	DS = WS = TD
Kind of errors				
Orthographic	6.6 (5.9)	8.2 (5.5)	3.1 (3.3)	DS = WS = TD
Syntactic	0.9 (1.3)	1.4 (1.9)	1.2 (0.9)	DS = WS = TD
Presence of logical link	92%	42%	100%	DS < WS=TD
Text copying				
Errors/times	0.01 (0.02)	0.01 (0.01)	0 (1.3)	DS = WS = TD

WS = Williams syndrome; DS = Down syndrome; TD = typical development; F = female; M = male; CA = chronological age; MA = mental age.

number of errors. In the pseudoword dictation task participants with DS made more errors than WS and TD children (WS vs DS, $p = .00004$, $d = .8$; TD vs DS, $p < .000001$, $d = 1.5$). Also participants with WS made more errors than TD children ($p = .004$, $d = 1.2$).

Furthermore, both in words and in pseudowords groups did not differ for the kind of errors made (Words: $\chi^2(4)$: 0.29, $p = .99$, p after Yates' correction = .09; Pseudowords: $\chi^2(4)$: 1.63, $p = 8$, p after Yates' correction = .83).

In the text composition the occurrence of logical links differed between groups (χ^2 (2): 10.45, $p = 005$, p after Yates' correction = 034) since participants with DS produced less logical links than TD children ($\chi^2(1)$: 7.22, $p = .007$, p after Yates' correction = .03).

Also in the text composition groups did not differ for the kind of errors made ($\chi^2(2)$: 0.54, $p = .76$, p after Yates' correction = .94).

For what concern the text copying task, the three groups did not differ for the errors/times rate [$F(2, 33) = 1.46$, $p = 24$]. Results on the indexes of handwriting revealed no difference between groups in the letter *orientation* ($\chi^2(6)$: 5.01, p-value = .54, p-value after Yates' correction = 89), in the *pressure* applied to the paper ($\chi^2(2)$: 3.7, p-value = .16, p-value after Yates' correction = .43), and in the letter *size* ($\chi^2(2)$: 5.33, p-value = 06, p-value after Yates' correction = 17).

4. Discussion

This study was aimed at investigating writing abilities of two different aetiological groups with ID. To this aim, individuals with DS and WS were compared to a control group formed by TD children matched for MA.

We examined different aspects of writing abilities as low-level transcription skills, orthographic competence, and text composition skill.

The two clinical groups demonstrated a distinctive profile with specific weakness and straight, albeit with some similar characteristics. More specifically, a common pattern between syndromic groups and controls emerged in writing a list of objects placed in bedroom, in errors in the text composition task, in the text copying task and in kinds of errors made.

However, groups differed in word dictation task since DS participants made more errors than WS and TD and in pseudoword dictation task in which both groups with ID made more errors than TD children.

Our results showed that writing abilities in WS is at the level expected for RA and MA except for the pseudoword dictation task, in which they made more errors than controls. According to the Frith's model (1985), this result suggested that individuals with WS were able to use lexical strategy to directly access to the orthographic form of the word. This confirms what already reported on reading, in which the ability to read a list of words and a text was found preserved in individuals with WS (Menghini et al., 2004). If the lexical recall of the written word in participants with WS derived mainly from years of writing exposition or rehabilitation programs then both WS and DS participants should exhibit a similar number of orthographic errors. Indeed, after a preliminary program based on phoneme/grapheme conversion, therapeutic approaches to teach writing in people with ID commonly make use of high frequency sight words to memorize the words as a whole by sight (whole-word instruction), so that these words can be automatically written without having to use any synthetic phonics strategies for phoneme/grapheme conversion (Dallapiccola & Vicari, 2012; Marotta, Menghini, & Vicari, 2011). Participants with DS, who underwent similar therapeutic programs, should then develop orthographic abilities comparable to those of participants with WS. However, individuals with DS made more errors in word writing than WS and TD children, and hypothesis of the existence of a specific profile in different genetic syndromes has been supported.

Regarding pseudowords, our results supported the prediction based on studies on reading in which both groups with ID showed lower performance than TD children (Lemons & Fuchs, 2010; Menghini et al., 2004; Næss et al., 2012; Steele et al., 2013; Verucci et al., 2006). This result confirmed in writing better orthographic knowledge than sound to print conversion skills in individuals with WS. Moreover, as expected, in participants with DS more errors than WS and TD children were documented in writing pseudowords, probably due to their phonological difficulties in expressive language (Kent & Vorperian, 2013) and in analyzing words into component phonemes and grapheme (Byrne, MacDonald, & Buckley, 2002; Kay Raining Bird et al., 2008). Participants with DS showed deficits both in whole word process and in phoneme–grapheme conversion as attested by their difficulties in the word and pseudoword dictation tasks. These results could be interpreted as evidence of the overuse of an early logographic phase (Frith, 1985) and the adoption of a visual memorization strategy of the whole word (to be distinguished from the orthographic and lexical processes of more fluent writers). It has been suggested (Fidler, Philofsky, Hepburn, & Rogers, 2005) that the relatively preserved visual processing abilities found in individuals with DS could support writing activity in order to overcome their verbal processing deficits.

Concerning text writing, the three groups did not differ in words/episodes rate, in errors/words rate and in the kind of errors made. Although text composition is a high-level skill and the presence of ID could influence this ability, the scholar level of TD children, who attended the second grade class, could be the reason for the result. Indeed, participants with ID attended school for more years than TD children and so they had definitely more opportunities to be engaged in written narration. However, differently from TD children and from participants with WS, the ability to report events with coherence was found reduced in DS, as documented by the lower number of logical links found in the text written. Difficulties in analogical and categorical reasoning have been already reported in individuals with DS when compared to MA-matched children (Natsopoulos, Christou, Koutselini, Raftopoulos, & Karefillidou, 2002). Following Natsopoulos et al. (2002), our finding may be interpreted as the consequence of their specific cognitive profile with deficits in several processes involved in the task as encoding premises, transferring information to working memory, representing metric relations expressed by

each premise, combining the premise representation in memory to create an integrated meaning, and in forming a conclusion may explain this finding.

Finally, individuals with ID and TD children did not differed in handwriting indexes. This result could reflected more visual–spatial and praxic-executive abilities (neuromotor speed, graphomotor model and allographic recovery) than writing skills (Tressoldi & Sartori, 1995). Similarly, regarding indexes of handwriting, results revealed no difference between groups in any parameter considered (letter orientation, pressure, letter size). To our knowledge only a study evaluated the quality of handwriting in adults with DS (Tsao et al., 2011) documenting a different quality of handwriting and deficits in the spatial organization compared to the control group matched for CA, but, as in our study, similar competence compared to the control group matched for MA. Similarly, in WS, handwriting abilities were found impaired compared to CA-matched controls (Nakamura et al., 2009).

Overall, our data support the hypothesis that writing deficits are syndrome related and not just a consequence of the ID. This 'syndrome-specific' view believes that the existence of specific cognitive profile in genetic syndromes is a consequence of neurobiological factors caused by the genetic abnormalities and expressed in abnormal brain maturation (Brock, Jarrold, Farran, Laws, & Riby, 2007; Galaburda & Bellugi, 2000; Mervis & Robinson, 2000; Schmitt, 2001; Vicari & Carlesimo, 2002, 2006; Vicari, Bellucci, & Carlesimo, 2000; Vicari et al., 2001, 2004; Wang & Bellugi, 1993;Vicari, Bellucci, & Carlesimo, 2006). Although examples of syndrome-specific position derives from studies comparing WS and DS on linguistic and visual–spatial abilities (Atkinson et al., 2001; Bellugi, Korenberg, & Klima, 2001; Vicari et al., 2001), no evidence has been so far collected comparing the two syndromes on writing abilities. Our results support the syndrome-specific view in documenting differences in writing abilities between groups with WS and DS. Specifically, in individuals with WS were found more errors than TD children only in the pseudoword dictation task as a possible effect of difficulties in the phoneme–grapheme conversion mechanism. However, beside more errors in pseudoword dictation task, in individuals with DS more errors were documented also in the word dictation task, as the consequence of difficulties in employing also orthographic and lexical knowledge.

Even if more investigations are needed especially on the first phases of learning to write to define rehabilitation programs (alphabetic- or lexical-modality oriented), our results offer some suggestions for teachers and therapists. In particular, it may be important to undertake specific programs based on grapheme–phoneme association to reinforce alphabetic principle in both groups with ID. For individuals with WS, the advantage for lexical strategy and the storage of the orthographic form of the word should be strengthen.

In conclusion, contrary to many pessimistic views who believe children with ID can not achieve sufficient skills in school, the present study showed good potential in different aspects of writing, involving not only low-level transcription skills but also high-level composition skills and indicated that writing abilities are not just a consequence of the presence of ID. Compared to few results found in English, the simplicity of the Italian orthography may have a role in supporting good writing processes in our participants with ID, due to the less complex and less contextual sensitivity of the correspondences between phoneme and grapheme.

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