POOR WRITTEN AND ORAL TEXT COMPREHENSION IN THIRD GRADE CHILDREN: A MULTIPLE CASE STUDY

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ABSTRACT: In this multiple case study we analyzed oral text comprehension, reading profiles and underlying cognitive abilities (attention, executive functions, working memory, narrative memory, rapid automatized naming and vocabulary) of 9 children identified as poor written text comprehenders after a school screening on 75 third grade children. Four out of the nine children were named *Language-Minority* (L-M) children, since they had immigrant parents. The remaining five children were born in Italy from Italian parents. The comparisons of the two subgroups suggested that the lexical route of reading was particularly impaired in the L-M subgroup and that written text comprehension was weakened by a restricted vocabulary that, in turn, was not supported by an efficient phonological short-term memory. In a second type of data analysis we examined the individual profiles of the nine children, irrespective of their belonging to the L-M or Italian subgroups, and identified different patterns of associations among reading performance, written text comprehension and oral text comprehension. The findings showed that poor text comprehension always co-occurred with word and/or text reading difficulties that, in turn, were associated to slow naming and weak verbal working memory. Moreover, when children had both written and oral text comprehension difficulties, not only verbal working memory was impaired, but narrative memory too, suggesting a weakness of the episodic buffer (Baddeley, 2000; 2010). The implications of poor working memory associated to slow naming and/or weak episodic buffer for text comprehension are discussed.

KEYWORDS: Written and Oral text comprehension; Reading profiles of Language-minority children; Verbal working memory and text comprehension; Slow naming and text comprehension; Episodic memory and text comprehension.

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I. INTRODUCTION

Studies on children's reading comprehension have shown that both lower-level skills, such as word reading efficiency and vocabulary knowledge, and higher-level skills, such as working memory, executive functions, grammatical awareness, inference generation and metacognitive strategies are related to reading comprehension (Carretti, Borella, Cornoldi & De Beni 2009; Cain, Oakhill, Barnes & Bryant 2001; Cain 2003; Florit, Roch & Levorato 2013; Seigneuric & Ehrlich 2005; Sesma, Mahone, Levine, Eason & Cutting 2009). Weaknesses in listening comprehension are part of such complex pool of factors, undermining text comprehension of children having average or good word reading skills (Clarke, Snowling, Truelove & Hulme 2010; Hulme & Snowling 2011; Nation & Snowling 1997).

Despite the wide range of cognitive and linguistic factors related to efficient text comprehension, word reading and listening comprehension seem to explain the majority of variance in reading comprehension when a latent variable approach is adopted (Bonifacci & Tobia 2017; Kim 2015; Foorman, Koon, Petscher, Mitchell & Truckenmiller 2015; Kim 2017). This finding corroborates a main prediction of the well known *simple view of reading* model (Gough & Tunmer 1986; Hoover & Gough 1990) showing that reading comprehension depends on word decoding and linguistic comprehension: variable combinations of efficiency in such two independent processes explain the level of children's text comprehension.

The assumption of "independency" between word decoding and listening comprehension (Cain & Oakhill, 2007) is indirectly suggested by the different influence that the two abilities seem to exert on reading comprehension longitudinally. Florit, Levorato and Roch (2008), in a sample of third and fifth grade Italian children found that reading comprehension had higher correlations with word decoding in third grade and with listening comprehension in grade fifth. A similar pattern is shown by a longitudinal study with Dutch children (Verhoeven & van Leeuwe 2012): word decoding predicted reading comprehension less strongly with the progression of primary school grades, whereas listening comprehension had an increasing role.

Different results emerge from Tobia and Bonifacci (2015) who investigated a large sample of primary school students, showing that from first to fifth grade, listening comprehension was always the best predictor of reading comprehension. Also other studies investigating reading comprehension in children who learn transparent orthographies found that listening comprehension was a main predictor of reading comprehension since the first grade (de Jong & van der Leij 2002).

We may ask if learning to read in a non-native language does substantially change the important influence of listening comprehension in written text comprehension. A study investigating language-minority primary school children learning Italian as a second language (Bonifacci & Tobia 2016) found that listening comprehension and decoding accuracy formed distinct and independent predictors, with listening comprehension explaining a much larger proportion of variance and reading accuracy showing a small but significant influence in the group of children attending the first two years of primary school. The role of reading accuracy in affecting younger children's reading comprehension was interpreted by the authors as related to the tight association between children's vocabulary size in L2 and word reading accuracy.

Difficulties with reading accuracy have been documented not only for children's reading in a second language (Bellocchi, Bonifacci & Burani 2016) but also for children who were born from immigrant parents and were exposed to Italian mainly in the school context (Marineddu, Duca & Cornoldi 2006). These children differed from a typically developing control group more for word than non-word reading, for both parameters of accuracy and speed. It is not clear whether this finding can be explained by the limited size of children's vocabulary, in line with what has been observed on bilingual populations (Lervåg & Aukrust 2010). A weak word-reading could in fact be interpreted as a weak development of lexical reading that in turn could be related to more specific deficits (e.g., weakness in rapid automatized naming as suggested by Conrad and Levy 2011) rather than to vocabulary *per se*.

The important role of language abilities in affecting both word decoding and text comprehension challenges the assumption of independency between word reading and listening comprehension. As emphasized by Kim (2017) discourse comprehension depends on a broad set of language and cognitive functions. Skills such as vocabulary and grammatical knowledge allow the building of propositionally structured meaningful representations, that in turn require working memory and attentional control enabling a deep fine-grained processing of linguistic information held in memory. The representations generated by this basic level of text processing feed high-level inferential and comprehension monitoring processes.

Word reading, on the other hand, particularly in children learning transparent orthographies, is affected by rapid automatized naming (RAN). Several studies have shown that children who cannot name very quickly highly familiar visual stimuli are not fluent in reading (Bowers & Wolf 1993; De Jong & van der Leij 1999; Georgiou, Parrila & Papadopoulos 2013). Gasperini, Brizzolara, Cristofani, Casalini and Chilosi (2014) found that a name-retrieval deficit as a cognitive impairment underlying RAN slowness was more likely in Italian children with dyslexia who have had an history of language disability. Slowness in accessing the words' phonological representations may affect word reading and also text comprehension, as suggested by Li, Kirby and Georgiou (2011). Latency of access to the words' meaning is likely to have detrimental effects on processing texts' linguistic information, particularly when a weak verbal working memory cannot provide an effective support to such processing.

In this multiple case study we analyze reading profiles, written and oral text comprehension in a small heterogeneous group of third grade children that participated at a school screening and were identified as poor text comprehenders. We first ask whether children born from immigrant parents (Language-Minority children) and children speaking Italian as native language show similar reading profiles. We then explore the reading and cognitive profiles characterizing the poor oral and/or written text comprehension in our sample of children.

II. Method

Participants and procedure

The participants of the present study were part of a wider group of children and were tested at three time points. At time 1 a group of 75 children attending third grade in two primary schools located in Rome were tested in their classroom with a multiple choice test assessing written text comprehension (Cornoldi & Colpo 2011). At time 2 (within 30 days from time 1) a group of 20 children who were judged to be "at risk" either for the low performance on the multiple choice test assessing text comprehension or taking into account the teachers' observations on their reading comprehension difficulties, were involved in individual assessment of written text comprehension (Bonifacci, Tobia, Lami, & Snowling 2014) and fluid intelligence (Raven, Court & Raven 1992; Italian version: Belacchi, Scalisi, Cannoni & Cornoldi 2008*).* The nine children who performed within normal limits in the fluid intelligence test and had a z score < -1 on written text comprehension participated at a subsequent individual assessment at time 3 (within a further 45 days interval from phase 2 testing). Such smaller group of nine children was then assessed for oral text comprehension, word and non-word reading, attention, executive functions, working memory, rapid automatized naming and vocabulary. In each assessment phase the children had a written informed consent signed by their parents. The individual assessments of time 2 and 3 took place in a quiet room within the school and were delivered by 5th year psychology students or trainees psychologists who had been involved in an intensive training course and were monitored by the last author.

The nine children (7 males and 2 females) came from middle and lower socio-economic catchment areas. The mean age was 104.8 months (8 years and 9 months; st. dev. 4.1 months). The different characteristics of the nine children are shown in TABLE 1. The Language-Minority subgroup (L-M) included four children (three males and one female; mean age 8 years and 7 months; st. dev. 2.4 months) who were born abroad and moved to Italy in the first three years of life (A.E.A. and M.R.) or were born in Italy from parents who were immigrants and for whom Italian was a second language (A.Y. and V.S.J.). All these children were deemed by their teacher to be fluent speakers of Italian. A.E.A.'s and V.S.J.'s parents reported that the native language was occasionally spoken by the child in family interactions, whereas M.R. spoke also Bengali and A.Y. Arabic. As shown in Table 1 three children in this group received a diagnosis, A.E.A. had an expressive language delay associated to general learning difficulties, A.Y. had a specific learning disability and V.S.J. an expressive language delay. Three children in the L-M subgroup required some individual adjustments of mainstream didactics and one (V.S.J.) was assisted by a special educator who, according to the Italian law, helps the children with special needs for a varying amount of time (accordingly to the severity of their impairment) within regular classes.

In the Italian subgroup (four males and one female; mean age 8 years and 10 months; st. dev. 4.8 months) the children C.N., Z.C. and B.D. were described by the teachers as having learning difficulties, but they had no diagnosis yet, whereas P.S. had a diagnosis of specific learning disability and R.S. of verbal dispraxia and both required some individual adjustments of mainstream didactics (as well as C.N.).

All the children's diagnoses were issued by public health clinics but the school did not receive a detailed written report on the child's areas of strength and weakness.

[INSERT TABLE 1 APPROXIMATELY HERE]

Materials

Written text comprehension was tested with the standardized MT battery (Cornoldi, Colpo & Gruppo MT 2011) which was administered as a group to the entire class in the initial screening phase. In this test the child is asked to read silently a narrative passage without a time limit and then answer to 10 multiple-choice questions. The child is allowed to see the text for the entire duration of the task. The score is the number of correct answers.

Text reading, written and oral text comprehension were evaluated with the battery for Assessment of Reading and Comprehension in Developmental Age (Bonifacci et al. 2014). For text reading we used the narrative passage "L'uovo di Colombo" (The Colombo's egg). The child was asked to read aloud the passage and was told that some comprehension questions would follow. Reading speed (number of syllables per second) and total number of errors were analyzed. The same passage was used for assessing written text comprehension as at the end of reading aloud the child was asked to respond to ten open comprehension questions on the passage. The child was told that he/she could look back at information within the written passage. For five of the questions the child had to consider only information explicitly presented in the passage (local comprehension), whereas the other five open questions required interpretation and inferential reasoning (global comprehension). For each question, a score of 0, 1, or 2 was given following the fixed criteria made explicit by the test manual. The test scores are the total scores for the answers to the ten questions. The scores of answers to local and global comprehension questions were also recorded. We used the same battery to assess *oral text comprehension* asking the child to listen to the narrative passage "La leggenda della merla" (The blackbird's legend). The examiner read aloud the text, and then asked the child to answer to ten comprehension questions. The child was not allowed to look at the written text. Type of questions and scoring were the same as for the written text comprehension task and, also in this case, total, local and global comprehension scores were obtained.

Word and non-word reading (Zoccolotti, De Luca, Di Filippo, Judica & Spinelli 2005) is a test consisting of words that vary for frequency (high and low) and length (short and long) and non-words that vary for length (short and long). Stimuli are presented in four 30 word lists and two 30 non-word lists. There is one list of high frequency short words, one with high frequency long words, one with low frequency short words and, finally, one with low frequency long words. Non-words are pronounceable strings of letters matched for length with the short and long words. Stimuli are laser printed in small case, Palatino font, size 12, and arranged in two vertical columns. The participant's task is to read aloud each list of stimuli as quickly and accurately as possible. The scores are the time in seconds and the number of misread stimuli per list.

Attention was evaluated with the Bells Test (Biancardi & Stoppa 1997) in which the participant must cancel 35 pseudo randomized bells found on a horizontal sheet of paper mixed with another 315 figures. The bells are located in seven columns, three in the right visual field, three on the left, and one in the centers. As the participant's task is to locate the bells and cross them out in the shortest possible time, and to repeat the search across four sheets, we used two main scores: the number of bells crossed in the first 30 seconds of each of the four sheets and the total number of bells crossed in the 120 seconds allowed for each of the four sheets. The first score, that is named

“Rapidity”, is likely to involve selective attention; the second score, “Accuracy”, taps the participant’s capability of sustaining attention effectively to the same visual search target.

Planning was assessed with *The Tower of London test* (Fancello, Vio & Cianchetti 2006) using a tool consisting of three pegs of various lengths, in which can be inserted three balls (one red, one green and one blue). The participant must move these marbles - with a specified number of moves - in order to obtain the configuration specified by the examiner with a picture and taking into account the rules that have been communicated at the beginning of the test. The total time to complete the task is measured with a stopwatch and correct responses are noted.

Inhibition and switching is a timed test of the Nepsy II battery (Korkman, Kirk & Kemp 2007; Italian version: Urgesi, Campanella & Fabbro 2011), assessing the ability to inhibit automatic responses in favor of novel responses and to switch between response types. In the Naming phase of the task, the participant looks at a series of black and white shapes (circle and square) or arrows (pointing up and down) and names either the shape or the direction. In the Inhibition phase, the child names the same symbols but is asked to apply the non-target label (e.g., saying “square” for a circle or “up” for an arrow pointing down). In the Switching phase, the child is asked to say the correct name for black symbols but to apply the non-target label if the symbol is white (e.g., “down” for a white arrow pointing up or “circle” for a white square). The completion time and the total number of mistakes (including self-corrections) are evaluated for naming, inhibition and switching.

Cognitive flexibility was tested with the Animal Sorting task from the Nepsy II (Urgesi et al. 2011). In this test the child is asked to sort pictures cards as quickly as possible into two groups of four cards each, using self-initiated criteria. The score is the number of correct different categories in which the participant sorts the pictures cards.

Problem solving was assessed with the Raven's Coloured Progressive Matrices (Raven, Court & Raven, 1992; Italian version: Belacchi et al. 2008) that was administered individually according to the standard approach described by Raven (1965). In this test, the child is required to complete a geometrical figure by choosing the missing segment from six choices. The test consists of 36 items divided into three sets of 12 (set A, set Ab and set B). Within each set, items are ordered in terms of increasing difficulty. Sets also vary in difficulty, with set B containing the most challenging items. The score is the total number of correct responses.

Rapid Automatized Naming (DeLuca, Di Filippo, Judica, Spinelli & Zoccolotti 2005) consists of three sheets of paper, each presenting a matrix composed of five stimuli repeated 10 times in random order, for a total of 50 stimuli. The stimuli in the *Color* matrix are five small 1.5 by 1.5 cm colored squares (black, blue, red, yellow and green); in the *Object* matrix they are line drawings of a hand, a train, a star, a pear, and a dog; the *Digit* matrix was composed of five repeated digits (2, 4, 6, 7 and 9). The children are instructed to name aloud the items as fast and accurately as possible, progressing row-by-row and left to right. The time to complete the task for each matrix is measured with a stopwatch and the errors are noted.

Lexical Access and Vocabulary is a test of the PAC-SP battery (Scalisi & Desimoni, in preparation) and consists of two four-by-five-item matrices of 20 stimuli each (line drawings of animals and objects). The stimuli of the two matrices differ in familiarity, with a medium level of familiarity for matrix 1 and a low to medium level for matrix 2 (the mean values for the stimuli in matrix 1 and 2 are respectively: name agreement 96.38% and 92.88%; familiarity 3.25 and 2.58; age of acquisition 3.58 and 5.40 years; Nisi, Longoni & Snodgrass 2000). Children are asked to name each picture in the matrix, working as fast and accurately as possible, progressing row-by-row and left to right. The time to complete the task for each matrix is measured with a stopwatch and the errors are noted. The accuracy score is the number of stimuli correctly named, and the speed score is the mean number of stimuli named per minute. The test provides two separate speed and accuracy scores for matrix 1 (Lexical Access scores) and 2 (Vocabulary scores).

Verbal short-term memory was assessed with a word span test that was the first part of the *Word Interference test* from *the Nepsy II* (Urgesi et al. 2011). The child is auditory presented with blocks of words increasing in span (from two to five) and is asked to repeat them in the same order. The number of blocks correctly repeated is the task score.

Verbal working memory was assessed with the Listening span test, an Italian adaptation (Palladino 2005) of the Daneman and Carpenter (1980) task consisting of sentences that are auditory presented in blocks of increasing span (from two to five). The participant is asked (i) to judge the plausibility of each sentence (state whether it is true or false) and (ii) to recall the last word of each sentence, in the correct order, at the end of each block. The total number of words correctly recalled *in order* provides one type of score. For instance, if a subject is presented with a five-span block and recalls the last word of the third and fourth sentences in the right order, the score in this block would be 2. Further types of score are the number of errors with sentence judgements and the number of intrusion errors, but these scores were not considered in the present study. Only the total number of words correctly recalled in order was considered.

Visuo-spatial working memory was assessed with an "Odd-one-out" task from the PAC-SP battery (Scalisi & Desimoni, in preparation). The material consists of sets of three shapes, that is, two circles filled with the same pattern and a circle filled with a different pattern. The test begins with a sequence of two stimulus cards. The child is presented with one stimulus card and asked to point to the odd-one-out shape. The stimulus card is removed and replaced with another stimulus card. Again the child is asked to point to the odd-one-out shape and remember its place. After the sequence the child is presented with a response sheet with six blank response boxes representing the positions of the shapes, and is asked to point to the spatial locations of all the odd-one-out shapes, in their original order. One point is awarded for each position pointed correctly. There are three trials within every sequence and the sequence length varies from two to five. Test administration terminates when the child fails on all the three trials of the same sequence. The total score is the number of positions correctly recalled.

Narrative Memory (Urgesi et al. 2011) is a test asking the participant to recall a short-story passage that was read aloud by the examiner. Credit is given for each correctly recalled element of the story, irrespective of whether recall is verbatim or in a sequence that is different from the heard story. The examiner then asks an open question for each element of the passage that has not been spontaneously recalled by the participant; afterwards there are yes-no questions to assess a recognition memory of the story. The score used in this study combines free and guided recall.

III. RESULTS AND DISCUSSION

Comparisons between language-minority and Italian subgroups

All the test scores were standardized for each child according to the means and standard deviations of the tests' normative data. All the z scores for errors and times were reflected so that positive z scores were always associated to better performances. In order to obtain joint accuracy + speed scores, accuracy and speed z scores were averaged for each of the following tasks: RAN (separately for Object, Color and Digit matrices), Lexical Access, Inhibition, Switching and Planning. RAN z scores for the three matrices were averaged to obtain a single RAN score.

We first focused on the reading comprehension profiles of Italian and L-M children observing that they were both characterized by a weak written text comprehension (z = -1.82 and z =-1.78). However, oral text comprehension tended to be within normal limits for the L-M subgroup (z = -0.65) and impaired for the Italian children (z = -1.52).

To explore whether written text reading, word recognition and the abilities underlying effectiveness of reading decoding - differ in the two subgroups of children we grouped z scores in different sets according to the abilities measured by the tasks. A discriminant analysis with group membership (Italian and L-M children) as dependent variable was performed on each set of z scores, with each z score in the set as a discriminant variable. The seven sets of variables, the mean z scores for Italian and L-M children and the results of the seven discriminant analyses are reported in Table 2. For each analysis the p value denotes the significance of the between-group variance explained by the overall set of variables; the percentage of correct classifications indicates the number of children correctly classified as Italian or L-M on the basis of their set z scores, and the highest standardized coefficients show which variables are the best predictors of group differences. Even though CPM and Text Reading Comprehension scores had been utilized as participant selection criteria (in the normal range for CPM and $z < -1$ for Text Reading Comprehension) these scores were included in the analyses in order to control for potential differences between groups.

The results of the seven discriminant analyses reported in TABLE 2 are described below.

[INSERT TABLE 2 APPROXIMATELY HERE]

<u>Text Reading</u>

Both groups showed low performances for the tests in this set (mean z scores were between -1.16 and -2.15) and their overall differences were not significant. Thus in both groups low written text comprehension was associated with low text decoding ability, affecting both reading accuracy and reading speed.

<u>High Frequency Words Reading</u>

The percentage of explained variance (71.77) was significant ($p < 0.05$) and all the children were correctly classified. The L-M mean z scores ranged between -3.14 and -2.45 and were lower than the Italian mean z scores (from -1.09 to -0.65). The speed for long words showed the highest standardized coefficient (2.58) and the speed for short words the lowest (1.86), whereas the coefficients for reading accuracy of short and long words were both high (2.38 and 2.440 respectively) thus High Frequency word reading accuracy predicted group differences better than High Frequency word reading speed. However, the contributions to the overall group difference of both accuracy and speed measures were quite close together, suggesting that lexical reading was less efficient in the L-M group. Thus, despite the common difficulties with written text reading, Italian and L-M children show a different profile, with L-M much weaker at the level of word reading, both for accuracy and speed.

Non Words Reading

The overall difference between groups was not significant, both groups showing lower mean z scores for accuracy (from -2.90 to -1.11) than for speed (from -1.60 to -0.08). The overall low performance of both groups on non-word reading tasks indicates that phonological decoding has not been fully automatized in both subgroups.

Naming Tasks

The percentage of explained variance (90.85) was significant ($p < 0.05$) and all the children were correctly classified. RAN was the best predictor of the group differences (standardized coefficient = 2.75) with a worse performance of the L-M compared to the Italian group (z scores -2.60 and -1.19 respectively). Also for Lexical Access the mean z score was lower in the L-M than in the Italian subgroup (-1.25 and -0.36 respectively). The mean z scores of both groups were in the normal range (from -0.49 to 0.08) for Vocabulary, but the L-M subgroup was less accurate and more rapid than the Italian subgroup. Thus the process of naming is much less automatized for children in the L-M subgroup and this weakness is likely to contribute to both slow and inaccurate word reading.

Verbal Memory

The percentage of explained variance (76.41) was significant ($p < 0.05$) and all the children were correctly classified. Mean performances on Verbal Working Memory were low for both Italian and L-M groups (-1.56 and -1.64 respectively) whereas mean performances on Narrative Memory were both low but in the normal range (-0.96 and -0.74 respectively). The significant overall difference between groups was due to Verbal Short Term Memory, with the highest standardized coefficient (1.26) and a lower mean z score for the L-M group (-2.07) compared to the Italian group (-0.39).

Non Verbal Tasks

The overall difference between groups was not significant, given that the two groups showed a similar mean profile, with mean z scores in the normal range for all the variables, with the exception of the accuracy scores for the Attention Task (-1.03 for the Italian group and -1.54 for the L-M one).

Executive Functions

Even in this analysis the two groups showed a similar mean profile and the overall difference was not significant. Mean z scores were in the normal range for all the variables with the exception of the Switching score of the L-M group (-1.06) and the Planning score for both groups (-1.11 for the Italian group and -1.03 for the L-M one).

To recapitulate the main differences, reading high frequency words was particularly poor in the L-M subgroup; each L-M child was also low in naming speed, and for two of these children naming was truly impaired (zeta scores ≤ -3). These findings suggest that the lexical route of reading was not well developed, similarly to what has been observed for Italian children with dyslexia (Zoccolotti, De Luca, Di Filippo, Judica & Martelli 2009).

Out of 6 children with a weak verbal short-term memory, four were L-M and in all but one child there was also a low vocabulary (30° percentile or lower for accuracy in low to medium frequency words). This suggests that a weak phonological short-term memory did not support vocabulary acquisition and, in turn, a restricted vocabulary contributed to poor text comprehension.

Factors underlying difficulties with written and oral text comprehension

We explored in a second type of data analysis whether there are reading and cognitive profiles that characterize subgroups of children, irrespective of their belonging to the L-M or Italian subgroups. We considered the zeta scores of each child for the tests that we conceive as particularly important for text comprehension and word reading. For text reading we considered accuracy and speed scores and selected, for each child, the lowest score between them. For word reading we considered accuracy and speed scores of short and long high frequency words and selected, for each child, the lowest score between them. The z scores of the nine children are plotted in Figures 1-3.

FIGURE 1 shows the zeta scores of four children (two L-M and two Italian) who have a general reading problem associated to poor text reading and poor oral and written comprehension. Two children in this group had a diagnosis of expressive language impairment (VSJ) or specific learning disability (PS).Their word reading was highly inaccurate and/or slow and was not supported by rapid automatized naming. Although not represented in the figure, vocabulary was also low (30° percentile or lower for accuracy in low to medium frequency words) for each child. Besides the difficulties undermining word recognition and a fluid quick access to word meaning in the reading process, other abilities did not provide a support for oral text comprehension either. Episodic memory of an orally presented story (Narrative memory in the figure) was poor for three children and weak verbal working memory did not allow a fine-grained processing of the text's linguistic information. Cognitive flexibility – that is likely to enhance the shift to new conceptual representations in a text's plot development - was within normal limits but low for three children.

[INSERT FIGURE 1 APPROXIMATELY HERE]

FIGURE 2 shows the profile of two Italian children (R.S. who received a diagnosis of verbal dispraxia and Z.C.) whose deficit in written and oral text comprehension was not associated to a more general reading problem, as their text reading was inaccurate but word reading was in norm for accuracy and within normal limits for speed. Again, episodic memory of an orally presented story and verbal working memory of text information was poor for these children.

[INSERT FIGURE 2 APPROXIMATELY HERE]

FIGURE 3 shows the zeta scores of three children (two L-M and one Italian) who have a general reading problem associated to poor text reading and written text comprehension. Their word reading and rapid automatized naming were strongly impaired and lack of quick access to the text's word meanings could not be compensated by a strong verbal working memory. However, when word meaning could be accessed in spoken language, as in listening to a narrative read aloud by the examiner, comprehension was in norm. Unlike the children whose oral text comprehension was also impaired (see Figure 2), narrative memory and cognitive flexibility was in norm or good for these children.

[INSERT FIGURE 3 APPROXIMATELY HERE]

IV. CONCLUSIONS

Our study involved a small group of third grade children who were identified as poor text comprehenders after a school screening. Out of 75 third grade children involved in the school screening, 12% showed poor written text comprehension. Our final small sample was a highly heterogeneous group consisting of four language-minority and five children speaking Italian as native language. For six of these children there was a diagnosis of either language impairments or learning disability. Fluid intelligence, assessed through the Raven Matrices (Raven, Court & Raven 1992; Italian version: Belacchi et al. 2008) was in norm for each child.

Comparing the two subgroups of language-minority and Italian children with a set of discriminant analyses we found that both L-M and Italian children were similarly poor in written text reading and comprehension. Underlying such common weaknesses they both had poor rapid automatized naming and poor verbal working memory. However, L-M children tended to be much weaker at the level of word reading, both for accuracy and speed; rapid automatized naming was severely impaired in two children of this subgroup. All L-M children were also consistently characterized by a weak verbal short-term memory and three of them by low vocabulary.

These results are in line with the longitudinal study of Bellocchi, Tobia and Bonifacci (2017) who found that phonological short-term memory, rapid automatized naming and vocabulary predicted reading speed more for bilingual than monolingual children in grade 1 and 2. As our small group had been selected for the low reading comprehension it is not strange that such predictors continued to affect L-M children in grade 3, undermining reading accuracy and not only reading speed.

We explored in a second type of data analysis the reading and cognitive profiles characterizing subgroups of children, irrespective of their belonging to the L-M or Italian subgroups. We found that text comprehension difficulties could be associated to a general reading problem affecting word recognition or to more restricted text reading difficulties, both in L-M and in Italian children. Thus when children are selected after a screening, their poor text comprehension is associated to reading difficulties–no matter of whether such difficulties encompass word recognition or only concern text reading.

Our findings also suggest that difficulties in word and/or text reading have two underlying factors that generate detrimental effects on text comprehension: slow naming and poor verbal working memory. When children read a text sentence in order to comprehend it they have to keep subsequent meanings in short-term memory to build a propositional representation. Such building has to contrast a natural decay of the semantic codes held in memory that is magnified by the long latency in accessing word-meaning if the reading process is characterized by slow naming (Li et al. 2011). When this natural decay of the semantic codes held in memory cannot be compensated by an effective verbal working memory, a fine-grained semantic processing of a text's sentences is impaired. Thus our finding raises the issue of the semantic consequences that slow naming associated to poor verbal working memory may generate on text reading and comprehension.

In children who do not have a word reading problem but only more restricted text reading difficulties, a slow naming speed can explain slow text reading but not their inaccurate text reading. We speculate that grammatical knowledge –being one of the predictors of text-reading fluency in young children (Kim, 2015)- is likely to underlie inaccurate text reading (in particular for morphologically complex units) in our third grade children who have overt or subtle (as suggested by Nation, Clarke, Marshall & Durand, 2004) language impairments.

A second finding of our analyses is that irrespective of whether poor written text comprehension is associated or not to a general reading problem, children may have a wider comprehension problem, affecting both written and oral text comprehension. Such association between poor oral and written text comprehension is indeed shown by six children, the 8% of the original sample involved in our screening. These children are not only characterized by poor verbal working memory, they also tend to have weaknesses in episodic memory (five out of six children). After listening to an orally presented story these children tend to recall few idea units both spontaneously and after the examiner's questions. When a child is listening to two-three sentences of a text read aloud by an adult, several semantically structured propositions should be linked together and integrated with knowledge of events, character's goals, etc. to construct a situation model of the text (Graesser, Singer & Trabasso 1994; Kintsch 1988). Such poor spontaneous and cued recall of a listened story suggests a weakness of the episodic buffer. This buffer in the Baddeley's model (2000, 2010) is a limited capacity temporary store forming an interface between different memory codes and enabling the integration of semantic codes with the listener's long-term knowledge of actions, events and mental states involved by the text's content. If semantic codes are not integrated with a child's schematic knowledge of the events described in the text to create a multimodal sequentially structured representation, immediate memory of the listened discourse is incomplete, as if the text had not generated visual imagery in a child's mind. The situation model of the text becomes then impoverished, and the child's recall is likely to be fragmented, sometimes centered on small details, or enriched with a child's invention of elements that were not present in the original text.

The role of episodic memory in children's text comprehension has been little investigated to our knowledge and deserves a systematic investigation in its relationship with semantic abilities (Nation & Snowling 1999) and verbal working memory.

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Child	Subgroup	Age (years; months)	Place of the child's birth	Age of immigration	Place of parents' birth	Languages	Diagnosis	Didactics
A. E. A. (female)	L-M	8.4	Morocco	Within the first three years of age	Morocco	Italian; Arabic (rarely practiced); French (only some words)	Expressive language delay and unspecified general learning disabilities	Individual adaptations of mainstream didactics
M. R. (male)	L-M	8.6	Bangladesh	Within the first three years of age	Bangladesh	Italian; Bengali	--------	Individual adaptations of mainstream didactics
A. Y. (male)	L-M	8.10	Italy	--------	Egypt	Italian; Arabic	Specific Learning disability	Individual adaptations of mainstream didactics Repeated two times the third class
V. S. J. (male)	L-M	8.9	Italy	--------	Spain	Italian; Spanish (only some words)	Expressive language impairment	Special Educator
C. N. (male)	Italian	8.11	Italy	--------	Italy	Italian	--------	Individual adaptations of mainstream didactics
Z. C. (male)	Italian	8.10	Italy	--------	Italy	Italian	--------	--------
P. S. (female)	Italian	8.2	Italy	--------	Italy	Italian	Specific Learning disability	Individual adaptations of mainstream

								didactics
B. D. (male)	Italian	8.10	Italy	--------	Italy	Italian	--------	
R. S. (male)	Italian	9.5	Italy	--------	Italy	Italian	Verbal dispraxia	Individual adaptations of mainstream didactics

Table 1 – Participants' characteristics in the Language-Minority (L-M) and Italian subgroups.

Name of the set of variables	Discriminant variables included in the set	MEAN Z SCORES Italian children	L-M children	DISCRIMINANT ANALYSIS RESULTS Standard. coeffic.	% expl. variance*	p	% correct classific.
Text reading	Written Text Compr.	-1.82	-1.78	-0.04			
	Text Reading accuracy	-1.48	-2.15	0.52	25.21	N.S.	66.66
	Text Reading speed	-1.16	-1.75	0.72			
Short and Long High Frequency Words reading	S-HFW accuracy	-1.09	-2.64	2.38			
	L-HFW accuracy	-0.85	-2.45	2.44	71.77	< 0.05	100.00
	S-HFW speed	-0.65	-2.51	1.86			
	L-HFW speed	-0.98	-3.14	2.58			
Short and Long Non Words reading	S-NW accuracy	-1.11	-2.90	1.03			
	L-NW accuracy	-1.29	-1.70	0.82	44.11	N.S.	77.78
	S-NW speed	-0.25	-1.60	1.32			
	L-NW speed	-0.08	-1.28	0.83			
Naming tasks	RAN (acc+speed)	-1.19	-2.60	2.75			
	Lexical access (acc+speed)	-0.36	-1.25	1.89	90.85	< 0.05	100.00
	Vocabulary (acc)	0.08	-0.49	2.31			
	Vocabulary (speed)	-0.28	-0.08	-2.78			
Verbal Memory	Verbal STM (acc)	-0.39	-2.07	1.26			
	Verbal WM (acc)	-1.56	-1.64	0.62	76.41	< 0.05	100.00
	Narrative Memory (acc)	-0.96	-0.74	-0.37			
Non Verbal Tasks	CPM (acc)	0.32	0.13	0.03			
	Visuospatial WM (acc)	0.49	0.78	-1.03	8.02	N.S.	44.44
	Attention (acc)	-1.03	-1.54	0.48			
	Attention (speed)	-0.37	-0.74	0.75			
Executive Functions	Cognitive Flexibility (acc)	-0.22	0.36	-0.58			
	Inhibition (acc+speed)	-0.07	-0.58	0.50	30.91	N.S.	66.67
	Switching (acc+speed)	-0.52	-1.06	0.65			
	Planning (acc+speed)	-1.11	-1.03	-0.05			

Table 2 - Mean Z scores of Italian and L-M children for all the measures and discriminant analyses results (standard coefficient for each discriminant variable, percentage of between groups variance explained by each overall set of variables, significance of the explained variance and percentage of correct classifications).
N.S. = Non significant.
*Percentage of between groups variance [(1-lambda)x100] explained by the overall set of variables.

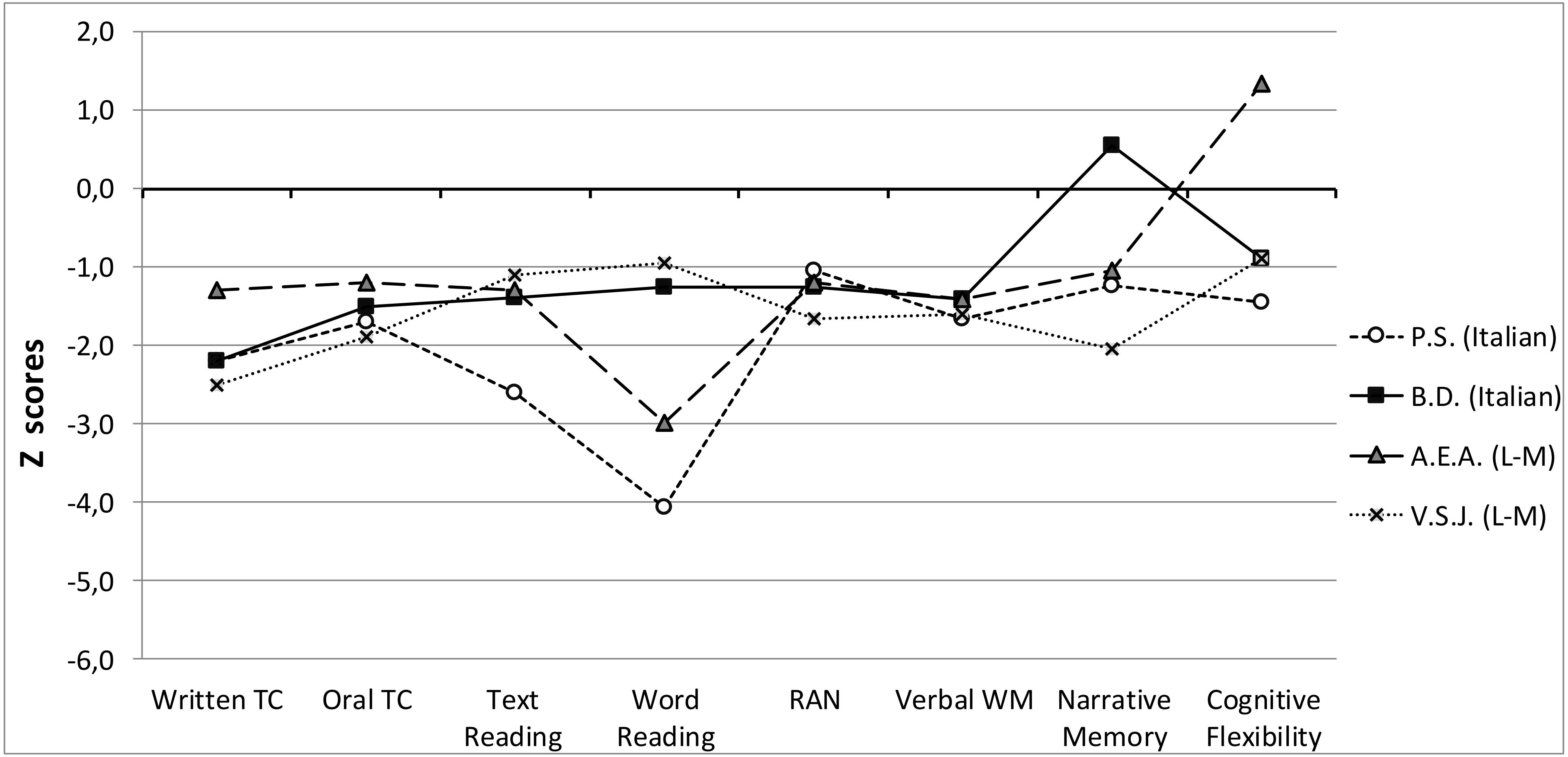

Figure 1. The performances of four children who have a general reading problem associated to poor text reading and poor oral and written text comprehension.

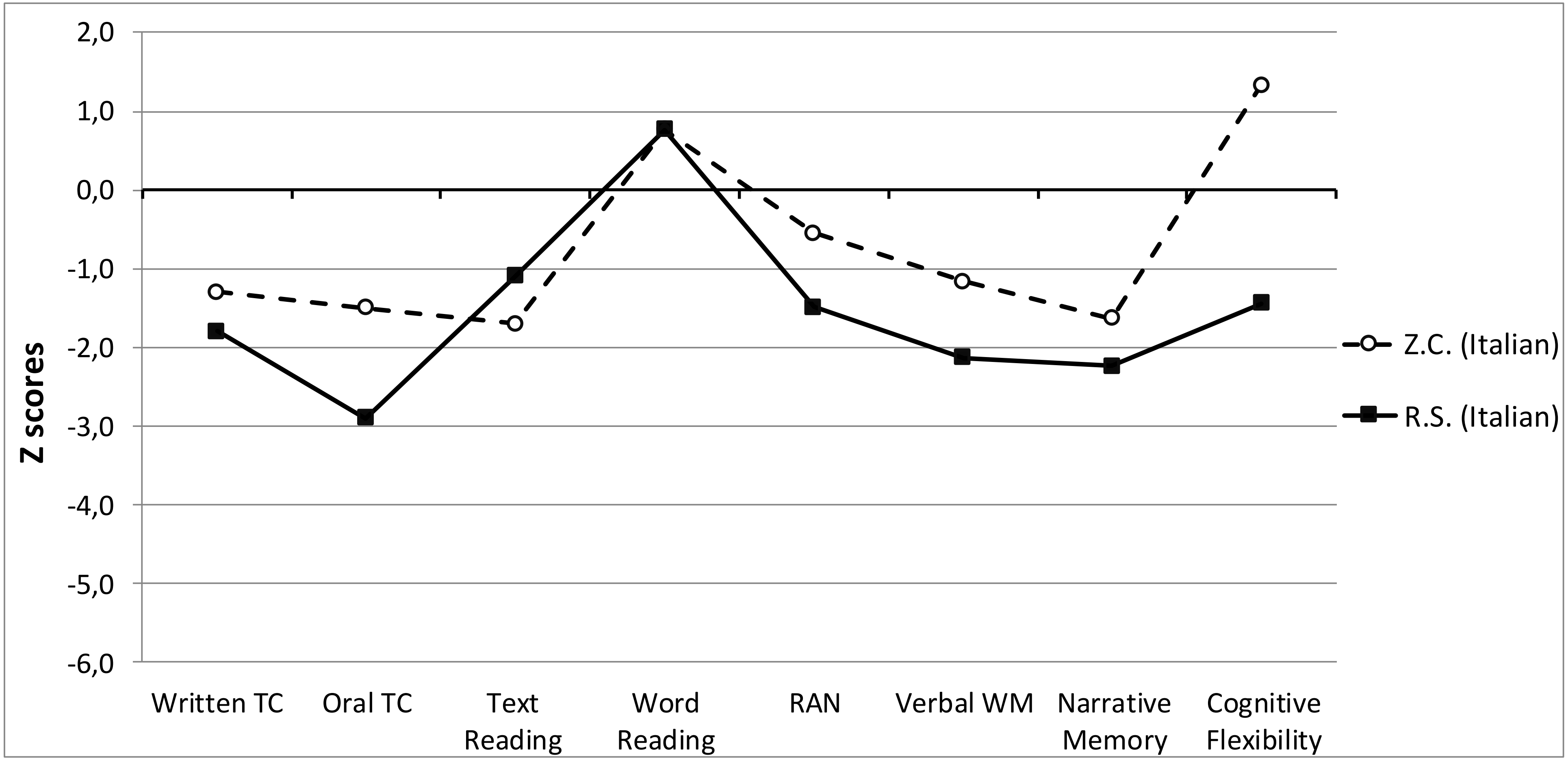

Figure 2. The performances of two Italian children whose deficit in written and oral text comprehension was not associated to a more general reading problem.

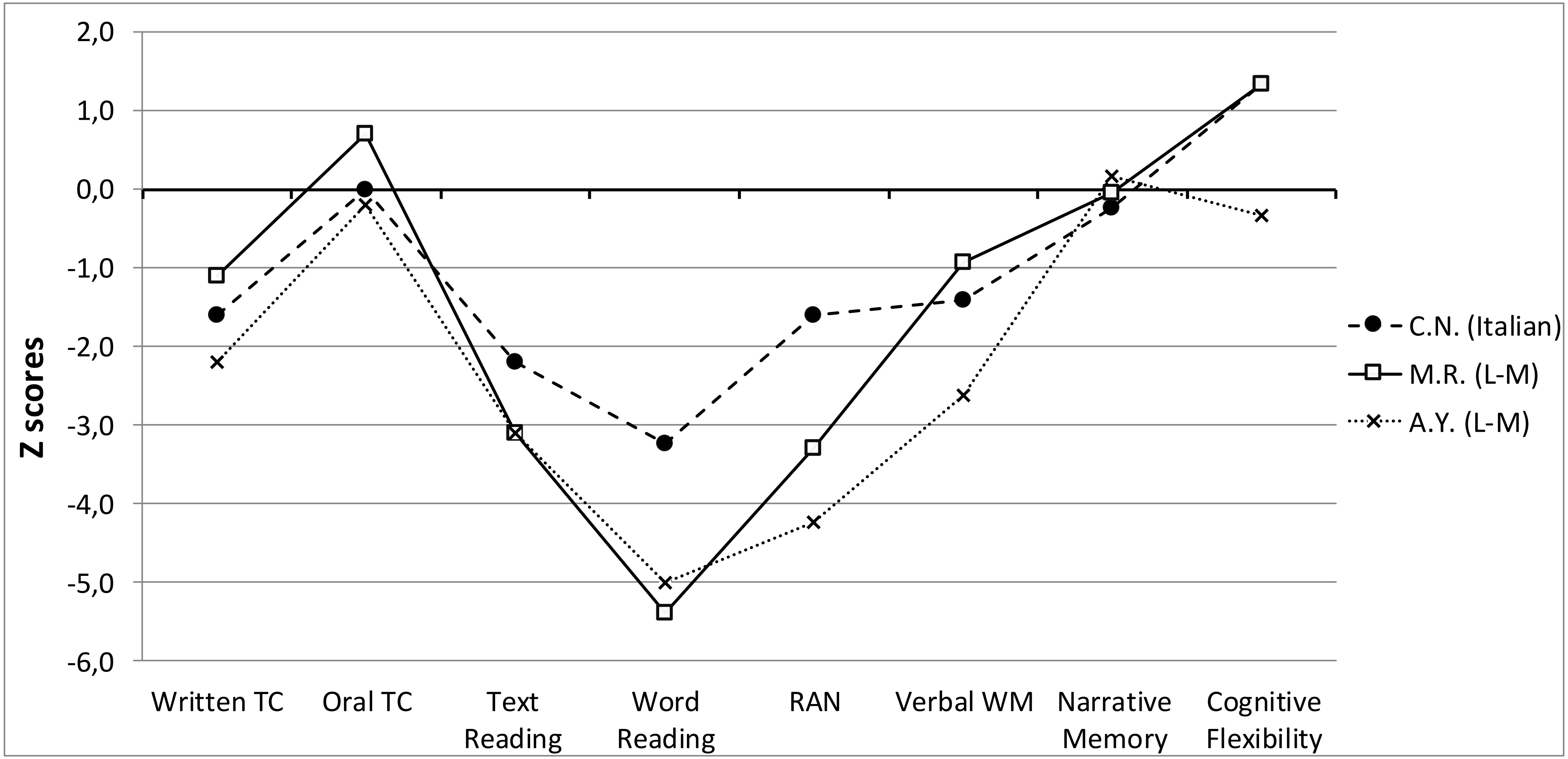

Figure 3. The performances of three children who have a general reading problem associated to poor text reading and poor written text comprehension.