

## The Prevalence of Reading Difficulties among Children in Scholar Age

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**Abstract:** The study investigates the prevalence of reading difficulties among children in scholar age and analyses the socio-demographic characteristics of learners who presented reading difficulties in central Italy. A sample of 623 students 7-11 aged, was assessed with the Italian MT standardized tests. Information on gender, age, handedness, and other socio-demographic variables were also gathered. The study showed that 11% of learners presented poor comprehension skills. The reading speed difficulties were more common than the reading correctness problems: about 7% of children vs 1% were dyslexics due to slow reading. There were no significant differences regarding gender, age. However, dominant hand and the school location seemed to affect the speed difficulties and the comprehension problems. The analyses showed that attending a school located in a rural area was statistically associated with the reading difficulties. Left-handed children were more likely to be slow decoders and/or poor comprehenders. These findings may be used in the early diagnosis of poor readers. These difficulties often have a chronic progression with substantial psychosocial limitations and psychological stress, so children with reading difficulties should be identified as early as possible.

**Keywords:** learning disabilities; poor decoders; poor comprehenders; dyslexia; handedness.

### 1. Introduction

Reading is a complex cognitive process and an important mean of language acquisition, communication, and sharing information and ideas (May, 1998). Reading transforms print to speech and print to meaning through a negotiation of meaning between the text and its reader, as an activity of problem solving (Snowling & Hume, 2008; De Beni & Pazzaglia, 1995). According to the Simple View of Reading, reading

is a multidimensional process, that include the decoding and the comprehension (Gough & Tunmer, 1986; Burgoyne, Whiteley, & Hutchinson, 2011). The two abilities are correlated and take time to develop. In fact, children become skilled and independent reader around 7-11 years old (Nation & Snowling, 1997a). The decoding and the comprehension skills, although correlated, depend on different cognitive and linguistic skills (Oakhill, 2003). On the other hand, children may experience two very different forms of reading problems: decoding difficulties (dyslexia) and reading comprehension difficulties (poor comprehension) (Elwér, Keenan, Olson, Byrne, & Samuelsson, 2013). Researchers have also identified two subtypes of poor readers: poor decoders and poor comprehenders, who show distinct cognitive and linguistic profiles (Geva & Massey-Garrison, 2013). Poor decoders, often defined as dyslexics (Vellutino, Fletcher, Snowling, & Scanlon, 2004), have difficulties with learning to read fluently, yet manage to comprehend what read reasonably well (Bishop, 2004). Poor comprehenders read words and sentences accurately, fluently and at age-appropriate levels, but have serious difficulty understanding what they have read (Nation, 2005). They are poor at making inferences when reading and listening to language (Cain, Oakhill, Barnes, & Bryant, 2001), exhibit difficulties in active processes, such as comprehension monitoring (Oakhill & Yuill, 1996), show impaired listening comprehension (Nation & Snowling, 1997b). The reading difficulties, in particular the comprehension problems, are not always diagnosed early in their life. Dyslexia is usually identified during the scholar age, but sometimes it is not diagnosed until much later, when more complex reading and writing skills are required. It is even harder to detect reading comprehension impairments in children before they are able to read with sufficient accuracy and fluency. Accordingly, most experimental reports of poor comprehenders include children who are aged 8 years and upwards (Cain, 2007). By this age, however, children have already begun to fail, complicating both the scholastic and clinical picture. In fact, reading difficulties may have long-term educational, social and economic consequences and increase the risk of developing psychological and emotional problems (Willcutt & Pennington, 2000; Kavale & Forness, 1996) and can persist for a lifetime (Shaywitz, Fletcher, Holahan, & al., 1999). Early recognition, evidence based on evaluation and treatments are necessary to achieve the best possible outcome.

## **2. Objectives**

The current research was designed to investigate the prevalence of reading difficulties among children in scholar age. Our study adopts a novel approach, looking at children aged 7-11 years old. We also analyze the prevalence of both decoding and comprehension problems, and we investigated the socio-demographic characteristics of children who presented reading difficulties. This study was part of the TERENCE project, an European FP7 ICT multidisciplinary project, aimed at developing an Adaptive Learning System (ALS) for supporting poor comprehenders and their

educators. The project was in the area of Technology Enhanced Learning (TEL) (<http://www.terenceproject.eu>).

### **3. Method**

#### **3.1. Participants**

The study was carried out in 3 months (January/February 2013), at three Italian public primary schools located in a rural or an urban area in central Italy. Public primary school in Italy is commonly preceded by three years of non-compulsory nursery school and it lasts five years: from the second grade to the fifth grade. Since from the age of 7 until the age of 11, children develop as independent readers (Nation & Snowling, 1997a), learners attending the first grade were not included in the study, as agreed with the respective schools.

We requested and obtained the written informed consent by parents.

Inclusion criteria were as follows:

- students 7-11 aged.

Exclusion criteria were as follows:

- inadequate knowledge of Italian language;
- lack of informed consent;
- diseases or health conditions that did not allow the assessment of reading performances.

#### **3.2. Measures**

Reading accuracy (the correctness), reading speed and reading comprehension were assessed with the Italian MT standardized tests (Cornoldi, 1996). The MT battery is the most commonly used psychometrically Italian instrument to measure these factors. The MT tasks are a measure of decoding and comprehension abilities in scholar age. The reading speed and correctness tasks were administered in individual setting, while the text comprehension task was administered in group. The test is made up of stories on the basis of the scholar skills. In detail, decoding ability is assessed by letting the child read a story in a short time. Two measures were calculated: reading speed and correctness. The speed variable consists in the time (in seconds) spent in reading activity, divided by the total number of the syllables of the story. The correctness variable takes into account the number of errors done during the reading activity. For measuring comprehension, the child is asked to read a story and answer a set of questions. The comprehension variable reflects the number of correct answers readers

select from a list of alternate choices. The higher the score, the better the reading performances (both comprehension and decoding performances). The child performances are compared with the score reported in the conversion tables for the Italian population and can be classified as normal or as risk condition in the reading ability. More precisely, depending on the class and on the score, a child can be assigned to one of the following clusters: “Need for immediate intervention” (NI), “Attention is needed” (AN), “Sufficient performance” (SP), “Complete performance” (CP). If a child belong to one of the first two clusters, he/she exhibits difficulties in decoding or/and in comprehension (i.e., he/she can be considered as a poor comprehender).

In addition to the MT standardized test, the study gathered information on gender, age, handedness, and other socio-demographic variables.

Descriptive statistics (mean and standard deviation for numeric variables, frequencies for categorical variables) were processed for all variables in the study. The Chi-square test or Fisher's exact test are used to examine differences with categorical variables. Odds ratios with 95% confidence intervals were calculated for the associations of socio-demographic characteristics with reading difficulties (Riffenburgh, 2012).

The statistical analyses reported below were performed through the software R 3.1.0.

#### **4. Results**

The sample was made up of 623 participants in scholar age, enrolled after informed consent given by their parents. The sample is almost balanced between boys (n=324, 52.01%) and girls (n=299, 47.99%),  $z=0.9980$ ;  $p=0.3190$ , with an average age of  $8.9\pm 1.1$  years. More precisely, 307 learners (49.28%) aged 7-9 years old, and 316 (50.72%) aged 9-11 years old. Furthermore, 145 students (23.27%) belonged to the second class, 162 (26.00%) to the third class, 194 (31.15%) to the fourth, and 122 (19.58%) to the fifth class. The majority of the children were right-handed (n=568, 91.32%). Only 54 students were left-handed (8.68%). Left-handedness was equally distributed between the two gender (27 males and 27 females,  $p=0.088$ ). 252 children (40.45%) attended a school located in an urban area; 371 (59.55%) a school located in a rural area.

The analysis of the scores obtained from the “MT” standardized test showed that, regarding the reading accuracy, 438 students (70.30%) had a complete performance and 176 (28.25%) a sufficient one. 7 learners (1.12%) needed for attention and only 2 children (0.32%) needed for immediate intervention. Regarding the reading speed, 582 students presented good results: 343 (55.06%) had a complete performance and 239 (38.36%) a sufficient one. Instead, 41 learners were too slow: 35 (5.62%) needed for attention and 6 students (0.96%) needed for immediate intervention. Regarding the comprehension, 218 learners (34.99%) exhibited a complete comprehension, 339

(54.41%) a sufficient one. For 63 students (10.11%) attention was needed and 3 children (0.48%) needed for immediate intervention. The clusters for the reading correctness, the reading speed and the comprehension, according to the socio-demographic characteristics, are shown in Table 1.

In particular, psycho-pedagogical data showed that 9 students, 1.44% of the sample,  $CI_{95\%}=[0.76\%-2.72\%]$ , had a not sufficient reading accuracy, 6 females and 3 males ( $p=0.3238$ , n.s.). They were all right-handed children and 3 belonged to the third class, 5 to the fourth and only a child to the fifth class ( $p=0.2264$ , n.s.). 6 students were in a rural school and 3 in an urban one ( $p=0.7456$ , n.s.). The reading correctness difficulties were more common in the older group than in the younger one (6 students aged 9-11 years old vs 3 children aged 9-11 years old,  $p=0.5050$ , n.s.). However, there were not significant associations between the correctness difficulties and the socio-demographic characteristics.

41 children, 6.58% of the sample,  $CI_{95\%}=[4.89\%-8.81\%]$ , showed an insufficient performance in the reading speed, 18 girls and 23 boys ( $p=0.5875$ , n.s.). 8 of them were left-handed learners and 33 right-handed ones. A statistically significant association existed between left-handedness and an insufficient performance in reading speed ( $p=0.0018$ ). The majority of slow decoders belonged to the second class (18 children) and to the fifth class (18 children). Only a child belonged to the third class, and 4 learners to the fourth one ( $p=0.0000$ ). 22 students aged 9-11 years old ( $p=0.8200$ , n.s.). 32 slow decoders were in a rural school, 9 in an urban one. A statistically significant association existed between school location in a rural area and an insufficient performance in reading speed ( $p=0.0125$ ).

The prevalence of children who presented a negative performance in the comprehensions was 10.59%,  $CI_{95\%}=[8.41\%-13.26\%]$  (66 students). Poor comprehension was balanced between boys and girls: 32 males and 34 females ( $p=0.5448$ , n.s.). 10 were left-handed learners and 56 right-handed ones. A statistically significant association existed between left-handedness and poor comprehension ( $p=0.0483$ ). Poor comprehension was more common in the second class (24 learners) than in the other classes (4 students in the third class, 18 in the fourth class, 20 in the fifth class,  $p=0.0000$ ), in the older group than in the younger group (38 children aged 9-11 years old vs 28 children aged 7-9 years old,  $p=0.2389$ , n.s.), in the rural schools than in the urban ones (52 children attended a school located in a rural area, 14 in an urban one). A statistically significant association existed between school location in a rural area and poor comprehension ( $p=0.0007$ ).

Table 1 shows the clusters for the reading correctness, the reading speed and the comprehension, according to the socio-demographic characteristics

**Table 1** Clusters for the reading correctness, the reading speed and the comprehension, according to the socio-demographic characteristics

<i>Socio-demographic characteristics</i>			<i>MT clusters</i>							
			<b>CP</b>		<b>SP</b>		<b>AN</b>		<b>NI</b>	
			<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>
<i>Correctness</i>	<b>Gender</b>	Male	221	68.21	100	30.86	3	0.98	0	0.00
		Female	217	72.58	76	25.42	4	1.34	2	0.67
	<b>Age range</b>	7-9 years	214	69.71	90	29.32	3	0.98	0	0.00
		9-11 years	224	70.89	86	27.22	4	1.27	2	0.63
	<b>Handedness*</b>	Right	403	70.95	156	27.46	7	1.23	2	0.35
		Left	34	62.96	20	37.04	0	0.00	0	0.00
	<b>Class</b>	II grade	117	80.69	28	19.31	0	0.00	0	0.00
		III grade	97	59.88	62	38.27	3	1.85	0	0.00
		IV grade	138	71.13	51	26.29	4	2.06	1	0.52
		V grade	86	70.49	35	28.69	0	0.00	1	0.82
<b>School location</b>	Urban area	186	73.81	63	25.00	2	0.79	1	0.40	
	Rural area	252	67.92	113	30.46	5	1.35	1	0.27	
<i>Speed</i>	<b>Gender</b>	Male	171	52.78	130	40.12	19	5.86	4	1.23
		Female	172	57.53	109	36.45	16	5.35	2	0.67
	<b>Age range</b>	7-9 years	185	60.26	103	33.55	14	4.56	5	1.63
		9-11 years	158	50.00	136	43.04	21	6.65	1	0.32
	<b>Handedness*</b>	Right	312	54.93	223	39.26	29	5.11	4	0.70
		Left	31	57.41	15	27.78	6	11.11	2	3.70
	<b>Class</b>	II grade	58	40.00	69	47.59	13	8.97	5	3.45
		III grade	127	78.40	34	20.99	1	0.62	0	0.00
		IV grade	86	44.33	104	53.61	4	2.06	0	0.00
		V grade	72	59.02	32	26.23	17	13.93	1	0.82
<b>School location</b>	Urban area	163	64.68	80	31.75	9	3.57	0	0.00	
	Rural area	180	48.52	159	42.86	26	7.01	6	1.62	
<i>Comprehension</i>	<b>Gender</b>	Male	119	36.73	173	53.40	30	9.26	2	0.62

	Female	99	33.11	166	55.52	33	11.04	1	0.33
<b>Age range</b>	7-9 years	107	34.85	172	56.03	27	8.79	1	0.33
	9-11 years	111	35.13	167	52.85	36	11.39	2	0.63
<b>Handedness*</b>	Right	203	35.74	309	54.40	53	9.33	3	0.53
	Left	15	27.78	29	53.70	10	18.52	0	0.00
<b>Class</b>	II grade	29	20.00	92	63.45	23	15.86	1	0.69
	III grade	78	48.15	80	49.38	4	2.47	0	0.00
	IV grade	79	40.72	97	50.00	18	9.28	0	0.00
	V grade	32	26.23	70	57.38	18	14.75	2	1.64
<b>School location</b>	Urban area	82	22.10	237	63.88	49	13.21	3	0.81
	Rural area	136	53.97	102	40.48	14	5.56	0	0.00

CP="Complete performance"; SP="Sufficient performance"; AN="Attention is needed" NI="Need for immediate intervention"

\*Numbers within categories may not total 623 because of missing data

Table 2 summarizes the odds-ratios for handedness and school location wrt speed and comprehension difficulties, that were found statistically significant in the analyses reported above.

**Table 2** The odds-ratios for handedness and school location wrt speed and comprehension difficulties

		<i>Speed difficulties</i>			<i>Comprehension difficulties</i>		
		<b>n</b>	<b>%</b>	<b>OR, CI<sub>95%</sub></b>	<b>n</b>	<b>%</b>	<b>OR, CI<sub>95%</sub></b>
<b>Handedness</b>	Right	33	5.81	1	56	9.86	1
	Left	8	14.81	2.68(1.06-6.69)	10	18.52	2.07(1.01-4.31)
<b>School location</b>	Urban	9	3.57	1	14	5.56	1
	Rural	32	8.63	2.55(1.16-6.18)	52	14.02	2.77(1.47-5.54)

#### 4. Implications

Reading is a deliberate activity of looking at and understanding the meaning of text by interpreting the characters or symbols of which it is composed (Cobb, 2007). Most children learn to read and spell with very little explicit instruction, but some of them have greater difficulties. Nowadays, despite intensive instruction, many learners fail to reach functional levels of reading both in decoding and in comprehension skills. The inability to read accurately and fluently and to understand what they have read is a major obstacle to learning. This has huge costs for the people affected and also for wider society. In the United States, about 2.6 million children aged 6-11 years have a learning disability (Shaywitz, 1998), and approximately 80% of people with learning disabilities have decoding problems (Shaywitz, 2003). Furthermore, more and more children of 7-11 years old turn out to be poor comprehenders (Lyon, Fletcher, & Barnes, 2003). Despite the high prevalence, limited informations are available about both such a prevalence, the nature of reading difficulties and the factors that underlie these problems. The diagnosis of reading ability should cover speed, accuracy and comprehension when reading. Using an observational study, a large sample of children was assessed.

The aim of this study was to describe the early reading skills that characterized children in scholar age.

Dyslexia is fairly widespread with prevalence, ranging from 3% to 10% (Snowling, 2013). The frequency of dyslexia differs between languages, being higher in English than in Italian, for instance (Lindgren, De Renzi, & Richman, 1985). Evidence in the literature suggests that Italian dyslexic children are characterized by a pervasive reading speed deficit, with relatively preserved accuracy (Tressoldi, Stella, & Faggella, 2001) and that dyslexia seems to affect boys more than girls (Rutter, Caspi, Fergusson, & al., 2004). In our study this was true for the reading speed problems, but not for the reading correctness difficulties, however there were not significant differences between two genders. In agreement with the scientific literature, our study also showed that in 7-11 age range, the reading speed difficulties were more common than the reading correctness problems: about 7/100 children vs 1/100 ones were dyslexics due to slow reading.

However, among reading difficulties, poor comprehension was the most frequent disease: 11% of learners had difficulties in understanding what they have read. This prevalence can be considered high when compared with other studies (Lyon, Fletcher, & Barnes, 2003). In contrast to previous studies (i.e., Yuill & Oakhill, 1991), in our study, poor comprehension was balanced between genders.

Furthermore, literature also suggests that the reading problems, in particular poor comprehension, are often identified late, during the last years of primary school or after primary school, at the age of 13 years (Caretti, De Beni, & Cornoldi, 2007). In our study, the reading correctness difficulties and the reading comprehension problems



were more common in the older group than in the younger one. The prevalence of reading difficulties by grade differed somewhat, with a higher prevalence in fourth grade for the reading correctness problems, in the fifth grade for the reading speed problems and in the second class for the comprehension problems. Approximately 17% of second graders were classified as poor comprehenders.

Furthermore, a statistically significant association between the school location and reading difficulties (the reading speed problems and the reading poor comprehension) was found. The analyses showed that attending a school located in a rural area was statistically associated with the reading difficulties. Research on the role of area in children's development has often investigated the effect of the environment on the physical activity and sedentary behavior (Machado-Rodrigues et al., 2012), the eating behavior (Story, Neumark-Sztainer, & French 2002) and the antisocial behavior (Rhee & Waldman, 2002). Yet, few studies have examined the association between urban/rural environment and children's early academic skills Miller & Votruba-Drzal, 2013). In our study, we have found that attending a school located in an urban area was a protective factor for the reading difficulties. We have also supposed that, probably, the majority of learners attending a school located in a rural area, also lived in a rural area. Perhaps, differences in the prevalence of the reading difficulties were due to the different nature of educational systems. In fact, social and cultural factors usually influence the prevalence of reading difficulties (Snowling, 2013). Some studies showed that differences in primary school children's cognitive outcomes, living in a rural or in an urban area, were largely attributable to the socio-economic characteristics of their parents (Midouhas, & Flouri 2013) or to a general condition of poverty (McLoyd, 1998; Yoshikawa, Aber, & Beardslee, 2012). However the relationship between the children, their environment and their performances at school is complex (Hanscombe, Haworth, Davis, Jaffee, & Plomin, 2011). There are usually some differences in activity preferences and participation patterns among learners living in an urban or in a rural location. Children living in a rural area participate more frequently than children living in an urban area in out-of-school activities (Brown, O'Keefe, & Stagnitti, 2011). We assume that the presence of several distractions may reduce the time spent on homework, encouraging the development of reading difficulties.

In our study significant associations between handedness and slow decoders and between handedness and poor comprehenders were also found. Early studies of language development showed an association between language dominance and handedness and/or eye preference (Benton & Kemble, 1960). The tendency to attribute cognitive, intellectual, or motor deficit to the left-handed children has a long history. For example, the right shift (RS) theory of handedness and cerebral dominance suggested that individual differences for patterns of cerebral dominance might be associated with different types of risk to cognitive functions (Annett, 1985). On the other hand, the analyses showed that dominant hand seemed to affect the reading speed difficulties (the reading speed problems and the reading poor comprehension). In

accordance with what has been observed by (Tønnessen et al. 1993), left-handed children were more likely to be slow decoders and poor comprehenders. Furthermore, in a meta-analysis of clinical studies children with literacy problems were more likely to be left-handed than control children (Eglinton & Annett, 1994). However research results with regard to handedness and dyslexia are still ambiguous (Vlachos, Andreou, Delliou, & Agapitou, 2013).

This study has the fallow limitations. Participants were not randomly selected from the sample, as expressly required by the respective schools. MT standardized test allowed an early identification of reading difficulties, but both dyslexia and poor comprehension are diagnosed based upon a synthesis of information from multiple sources.

## **5. Value**

Despite these limitations, the results have important implications for the reading difficulties among children in scholar age. The study investigated the prevalence of different subtypes of reading disabilities: the reading correctness difficulties, the reading speed problems and poor comprehension. Poor comprehenders have been studied less than children with dyslexia and the condition is not well recognised by teachers (Hulme & Snowling, 2009). This paper also analyzed the factors associated with these problems and the potentially important differences across subtypes. The findings about the prevalence of children at risk for different subtypes of reading disabilities as early as second grade may be used in the early diagnosis and treatment of poor readers. These difficulties often have a chronic progression with substantial psychosocial limitations and psychological stress, so children with reading difficulties should be identified as early as possible (Snowling, 2013; Knivsberg & Andreassen, 2008).

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