

Learning to Read: Evidence on the Distinction Between Decoding and Comprehension Skills

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The paper focuses on the importance of distinguishing between decoding and comprehension skills in reading. This distinction can also be applied to the study of precursors of reading and of the first phases of reading acquisition. The reconsideration of a 15-year research program shows evidence and implications of such a dissociation. In particular, the paper reviews psychometric research concerning reading performance in first and second grade, research on precursors of reading, the effects of early programs devoted to develop reading abilities. Decoding and comprehension reading components appear at least partially separated, related to different underlying cognitive abilities, differently sensitive to enrichment programs.

Early precursors and first phases of reading acquisition have been examined by a large number of studies. Not often, however, the acquisition of different components of reading has been separately considered.

Among the possible separations of reading components, one seems to deserve particular attention, i.e. the distinction between decoding and comprehension.

For example, theoretical approaches to reading, including some recent modular models (see De Beni & Pazzaglia, 1992; Olson 1988), have distinguished between phonological, syntactic and semantic processes, suggesting that in the case of decoding, the phonological component is used most and the semantic one least, whereas the opposite is true during comprehension.

Such a distinction has been stressed by many authors. We recently reviewed (Papetti, Cornoldi, Pettavino, Mazzoni, & Borkowsky, 1992) the evidence showing that decoding and

comprehension skills are at least partially separated and we argued that this may be particularly evident for Italian pupils, given the high transparency of the Italian language. Evidence in favour of such a distinction can be collected considering cases of developmental dyslexia, with poor reading but good comprehension, or of hyperlexia, with comparatively good decoding skills associated to poor comprehension (Aaron, Kuchta, & Grapenthin, 1988).

Other convergent evidence can be collected when behavior and performance of children are examined under 'decoding-oriented' or 'comprehension-oriented' reading instructions. Just and Carpenter (1987) found in the on-line consideration of patterns of reading that they are more regular when the subject is reading to decode than when he is reading for comprehension.

Cornoldi, Colpo and Gruppo MT (1981) argued that, in order to study the distinction, the procedures for examining comprehension and decoding must not be confused, as it may happen when they are tested at the same time. When the procedures were separated and different groups of children between 7 and 14 were tested, decoding and comprehension were not strictly related and sex differences in reading were more clearly evident in decoding than comprehension.

Papetti et al. (1992) also mentioned evidence concerning the precursors of reading and the early phases of reading acquisition. The point appears particularly relevant. By finding an early separation between decoding and comprehension and specific relations between a certain group of reading precursors and decoding on one side, and another group of reading precursors and comprehension on the other side, we should reach two important points: Firstly, we should increase our comprehension of the factors underlying reading abilities. Secondly, we should better understand the value of procedures devoted to predicting reading ability.

The present paper explores this issue by reexamining the research developed over the last 15 years on the first phases of learning to read. Although such a research was not always focused on the distinction between decoding and comprehension skills, it was always based on the use of different procedures for testing reading comprehension and reading decoding (the MT tests). These measures provide the possibility of reconsidering the empirical evidence of the distinction and its theoretical and educational implications.

The main purposes of the present paper therefore are:

- a) examining whether a distinction between comprehension and decoding is as evident in the first phases of reading acquisition as it is in the following phases;
- b) examining which are the main cognitive structures and processes underlying decoding and comprehension in these early phases;
- c) evaluating the predictive power of instruments used to forecast success in reading, distinguished on the basis of comprehension and decoding.

MT (Memory and Transfer) reading tests: Evidence concerning the distinction between comprehension and decoding in the first phases of reading acquisition

In the early 80s, our group investigated the theoretical and empirical implications of using some standardized tests to assess reading proficiency from the age of six to the age of fourteen. The investigation was triggered by the empirical evidence provided by a research program carried out in those years in a number of Italian primary schools. The results showed that teachers' assessment of reading proficiency was disturbing and posed some validity problems. In fact, teachers' evaluation of reading usually was highly correlated with accuracy and speed scores of standardized reading tests but dramatically less correlated with reading comprehension of the same standardized reading tests (Cornoldi, Colpo, & MT Group, 1981; Cornoldi & Fattori, 1979; Cornoldi, 1980). As a consequence, early detection of poor comprehenders was difficult.

This poor predictive ability partially derived from the lack of standardized reading tests available in class. Our group designed and prepared the above mentioned battery of tests (MT tests): some of the tests assess reading speed and accuracy and some assess reading comprehension. While subjects read aloud in the former tests, they read silently in the

latter ones and have no time and memory constraints. Subjects can use as much time as they like and are allowed to go back to the text, if they wish.

Empirical evidence provided by a number of studies using MT reading tests supports the distinction between decoding and comprehension in reading (Cornoldi et al., 1981). Some of this evidence was based on factor analyses on the scores of batteries of tests including reading tests. For example, Table 1 presents the factor matrix based on the scores obtained by first- and second-grade children in the following tests (in order from the top): Aural Digit span Test (ADST), Rhythm Test (RT), Visual span Test (VST), Syllables reproduction Test (SRT), Bender Visual-Motor Gestalt Test (BVMGT), Goodenough's Draw a Man test (GDMT), Lateral Dominance Test (LDT), Tale Memory test (TMT), first grade reading Comprehension test (Comprehension 1), first grade reading Accuracy test (Accuracy 1), first grade reading Speed test (Speed 1), second grade reading Comprehension test (Comprehension 2), second grade reading Accuracy test (Accuracy 2), second grade reading Speed test (Speed 2) (Pra Baldi, 1985).

Table 1

Saturations greater than .35 for the scores in the cognitive tests and in the reading achievement tests (Pra Baldi, 1985).

Scores	Tests	Factor 1	Factor 2	Factor 3	Factor 4
Cognitive test	ADST		.62		
	RT		.80		
	VST				
	SRT		.62		
	BMVMGT		.37		
	GDMT				.45
	LDT				.46
	TMT		.36		
Reading test	Comprehension 1			.43	
	Accuracy 1	.87			
	Speed 1	.92			
	Comprehension 2			.56	
	Accuracy 2	.60			
	Speed 2	.83			

Cornoldi and Fattori (1979), administered MT comprehension, accuracy and speed reading tests and a linguistic ability test to 186 subjects attending first and second grades. The linguistic ability test was the same for both first and second grade pupils. The other tests were different in terms of difficulty (comprehension tests were different also within the same grade). Pearson's linear correlation coefficients were computed between teachers' evaluation of pupils' reading performance, reading test scores and linguistic competence scores. On the whole, the correlation analysis results (see Table 2) provide evidence about differences between the variables of reading comprehension, speed and accuracy.

The accuracy (ACCURACY) and speed (SPEED) variables show a high correlation, with the correlation coefficient between decoding and comprehension being lower. Teacher's evaluation is strongly correlated with speed and accuracy test scores but shows a lower correlation with comprehension test scores. Comprehension is strongly correlated with linguistic skill scores only.

A factor analysis performed on reading and linguistic test scores and on teachers' evaluation scores shows (see Table 3) a first factor loaded by answers given to the first comprehension test (Factor 1, named reading comprehension factor); a second factor loaded by accuracy and speed tests and by teachers' reading assessment (Factor 2, named decoding factor); a third factor loaded by the answers given to the second comprehension test and by linguistic proficiency test (Factor 3, named linguistic proficiency factor).

Table 2

Correlation matrix between scores in reading tests, teachers evaluation and linguistic achievement (Cornoldi & Fattori, 1979)

	Compr.	Accuracy	Speed	Ling. achiev.	Teach. eval.
Comprehension	///				
Accuracy	.39**	///			
Speed	.20*	.61**	///		
Linguistic achievement	.55**	.34**	.29**	///	
Teachers evaluation	.37**	.66**	.46**	.34**	///

Note. * $p < .05$; ** $p < .01$

Table 3

Saturations greater than .35 for the scores in the reading achievement tests, linguistic achievement test and teachers evaluation (Cornoldi & Fattori, 1979)

Scores	Factor 1	Factor 2	Factor 3
Comprehension 1	.86		
Comprehension 2			.50
Accuracy		.79	
Speed		.84	
Linguistic achievement			.68
Teachers evaluation		.53	.48

Summarizing, Cornoldi and Fattori's Pearson correlation and factor analysis mirrors Pra Baldi's results: in first and second grade a strong link exists among decoding variables. Substantial independence is found instead between decoding and comprehension.

In a recent study (Cornoldi, Colpo, & Gruppo MT, 1990), different reading speed, comprehension and accuracy tests were administered to 120 first grade pupils, in January (intermediate tests) and in June (final tests) of the same year. All the tests used in the research were improved and updated versions of the original MT reading tests.

A factor analysis performed on reading test scores singled out two factors: Factor 1 (decoding factor) loaded intermediate tests of speed (Speed 1) and accuracy (Accuracy 1) with high saturation (.79) for both these variables. It also loaded final tests of speed (Speed 2) and accuracy (Accuracy 2), with lower saturation (.50 and .36, respectively).

Table 4

Saturations greater than .35 for the scores in the reading achievement tests (Cornoldi, Colpo, & Gruppo MT, 1990)

Scores	Factor 1	Factor 2
Accuracy 1	.79	
Speed 1	.79	
Comprehension 1		.80
Accuracy 2		.60
Speed 2	.50	.53
Comprehension 2	.36	.70

Factor 2 (comprehension factor) loaded partially different variables, with high saturation for intermediate and final comprehension tests (.80 and .70, respectively), and lower saturation for speed and accuracy final reading test (.53 and .60, respectively) (this last result could be due to the particular procedure adopted in that research) (see Table 4).

In general, these results suggest that decoding and comprehension are at least partially independent. Furthermore, the results show that the pattern of the relationship may change during learning to read. In particular, Cornoldi and Fattori's research allows to distinguish between first and second grade comprehension tests. In fact, the first grade comprehension test loads one factor of reading comprehension while the second grade comprehension test loads one factor of the linguistic proficiency test. This result could be explained by the characteristics of these tests: The first grade test is very easy and includes some pictures that make its performance only partially dependent on linguistic ability. The second grade test reflects the more complex texts a child is asked to read in second grade: it is therefore more difficult and its execution needs more linguistic skills. It is possible, however, that other factors related to the different phases of reading acquisition are involved.

Evidence on the distinction between reading comprehension and the two measures of decoding and among the decoding measures itself was indirectly collected by Cornoldi (1980), when he found that a memory training had partially different effects on the three considered aspects of reading (speed, accuracy, and comprehension). The author set up a training program aimed at enhancing the memory proficiency of a sample of 15 third grade reading-disabled pupils. The experimental group's performance was compared with the performance of a control group of the same age, IQ and linguistic achievement. The two groups' reading skills (decoding and comprehension) were appraised before and after the training. Results showed that the memory training was more useful than the traditional school practice in improving reading speed. Both control and experimental group attained the same improvement in reading comprehension. In this research the effect observed for reading speed was not associated to a parallel effect on reading accuracy, suggesting that sometimes (as it has also been observed in other studies, e.g. Bakker & Vinke, 1985) reading speed and reading accuracy can be dissociated.

Research on the prediction of different cognitive instruments on accuracy, speed and comprehension reading level

Cornoldi and Pra Baldi (1979) examined different memory, perceptual and linguistic variables involved in the early phases of reading acquisition in order to study the relationship with the different aspects of reading and to find out which variables could be used in identifying children with reading difficulties. In Italy most children attending first grade have low or null reading ability when they enter school. It is then possible to examine the relationship between their 'reading readiness' and their subsequent reading levels.

Cornoldi and Pra Baldi examined a sample of 109 children. The research was run in two different phases. In the first phase, all children were tested with a battery comprising the Frostig Developmental Test of Visual Perception, two linguistic oral tasks (a Closure test, based on the presentation of sentences where the last word was missing, a Phonemic blending task), four memory tasks: digit span, visual span, story recall, memory of rhythms, and the Gille Mosaic as an intelligence task. Furthermore, teachers completed a questionnaire related to six different aspects of behaviour in classroom: oral comprehension, oral expression, written language, spatial ability, motor coordination, social rules observance. At the end of the first class, all children were tested in reading (speed, accuracy and comprehension).

In order to specify the relationship between the predictors and the reading scores two different types of analysis were used: correlation-based analysis and contingency table based analysis. In fact, the use of correlational analysis assumes that there is a constant linear relation between the scores of the predictive variables and the scores of reading proficiency tests,

but often in this kind of tests the relationship holds below a critical value of the predictor and not above it.

In order to fill the contingency tables, the scores distribution of predictive and reading tests were divided sometimes in 3 parts (below the 33th percentile, between the 33th and the 66th, above the 66th percentile), sometimes in two parts (above and below the 50th percentile).

In order to evaluate the predictive value of the teachers' questionnaire, the correlation between questionnaire subtests scores, total scores and predictive tests scores were computed.

Table 5

Correlations between reading variables and teachers questionnaire scores (single area scores and total)

Questionnaire	Reading tests		
	Comprehension	Accuracy	Speed
Oral comprehension	.296***	-.503***	-.555
Oral expression	.199	-.363***	-.467***
Written language	.292**	-.497***	-.294***
Spatial ability	.219*	-.309**	-.421***
Social rules observance	.145	-.384***	-.445***
Motor coordination	.277***	-.398***	-.370***
Total	.194	-.455***	-.553***

Note. * $p < .05$; ** $p < .01$; *** $p < .005$.

As it is shown in Table 5, despite the inaccuracies involved in teachers ratings, the questionnaire scores are significantly correlated with reading achievement: total questionnaire score is related both to reading speed and accuracy, not to comprehension. All subtests are related to speed and accuracy and 4 subtests are related to comprehension. They are: oral comprehension, written language, orienting ability and motor coordination. The relationship between reading comprehension and oral comprehension or between reading comprehension and written expression is clear. It is more difficult to explain the relationship between comprehension and the two variables of motricity and spatial ability. The authors hypothesized that these two variables describe the general child's neurological maturity also influencing his cognitive growth.

The analysis of the predictive power of the cognitive tests revealed that the two above mentioned statistical methods of correlation analysis and contingency tables can produce different outcomes. In particular, the memory tests appear to be the most linked with reading variables, with similar results from the two different statistical analyses.

The span tests correlate with reading speed, accuracy and comprehension. The relationship between the memory of rhythms tests and reading is less clear. In fact, from the contingency tables memory for rhythms appears related to comprehension ($p < .01$) and from correlation matrix it resulted significantly correlated with both reading speed (Pearson's $r = .23$) and accuracy (Pearson's $r = .20$). These data suggest that although the relationship between memory for rhythms and comprehension is not maintained along all the values of the two variables, subgroups with extreme scores in this ability will present later different scores in comprehension.

The relationship between story recall and reading comprehension appears to be clear and particularly strong, both from contingency tables and correlational matrix.

The other prerequisite tests result less linked to reading skills with different results from correlation and contingency table analysis. Correlation analysis shows a significant correlation

between the reading speed scores and the closure test and between the reading speed scores and the phonemic blending test. Reading accuracy correlates with the closure test. Contingency tables reveal a relationship between reading comprehension and the mosaic of Gille.

To summarize, we found a different relationship between cognitive variables and the two main components of reading, comprehension and decoding (speed and accuracy). The teachers' questionnaire and the span tests seem the most useful to identify disabled readers.

In a second study, a group of subjects were longitudinally followed from first to third grade (Cornoldi, Pra Baldi, & Rubini, 1983). Similarly to the first study, a battery of cognitive tasks was administered to the subjects in the first class together with the Feshbach Observational Questionnaire. The cognitive battery included the following tasks: digit span, visual digit span, rhythms repetition, syllable repetition, story recall, Bender Gestalt Test, Goodenough's Draw-a-man test and a test of lateral dominance.

At the end of first and third grade, all the subjects were tested in reading (speed, accuracy, comprehension), segmentation and arithmetic. A regression analysis was applied to the data of the whole group. It emerged that the common variance between all the predictive variables and the school measures was 18% for reading comprehension, whereas it dropped to 7% for reading speed and accuracy. When reading achievement at the end of the first grade was considered, a test of non-word repetition entered for the equation (based on a stepwise regression analysis, $\alpha = .05$) related to accuracy, the Bender visual-motor test entered the equation reading speed, and still different tests (Feshbach, Stambak rhythms) entered for the equation comprehension. When the reading achievement at the end of second grade was considered, the equations remained as in first grade for comprehension and accuracy, whereas the best predictors for reading speed became auditory and visual digit span tests (see also Pra Baldi, 1985).

A second analysis was carried out only on the subjects that presented reading difficulties. The variables that in the previous analysis resulted more strongly correlated with the school measures were averaged and contrasted with the Feshbach Questionnaire for their predictive accuracy. In general, the cognitive variables were better predictors of subjects with reading problems than observational questionnaire. The proportions of subjects correctly identified in first grade were 67%, 44%, 13% for comprehension, accuracy and speed, respectively; in third grade the proportions for the same variables were 80%, 45%, 24%, respectively.

Pazzaglia and Cornoldi (1985, 1987) replicated the preceding investigations using, as predictive variables, 6 tasks devised by our group (Criterion Tests) on the basis of a task analysis of reading (Struiksmá, 1980). The tasks were the following: visual analysis, serial visual identification, verbal sequential memory, phonemic synthesis, visual-verbal integration, visual global identification. The Bender Gestalt Test and a visual span memory test were also administered.

A factor analysis on the predictive variables revealed three distinct factors: a factor of visual discrimination, a factor of short term memory and a factor of grapheme-phoneme association.

The relationship of the cognitive tests with the reading components measured at the end of first grade was analysed using a correlational design and a particular application of contingency tables which only considered the first and the last quartile of each distribution.

For these two studies, reading achievement was tested at the end of first grade, considering the three variables of comprehension, speed and accuracy. Stepwise multiple regression indicated that the set of tests was able to explain a small percentage of the variance in each reading score. In fact, the percentage of variance explained by prerequisite tests is: 9% for accuracy, 10% for speed and 31% for comprehension. These results are coherent with the theory underlying the creation of the Criterion Tests which define a criterion of performance. If a child is under that criterion he or she is considered at risk of failure in reading. However, for children above that criterion, no linear relationship is expected between prerequisite and success in reading. These results are common in this kind of research. In fact, usually the relationship between predictive variables and learning proficiency tests does not interest the whole distribution of

the scores, but only the extreme scores. So the examination of contingency tables often gives more informations.

In the present research 24 contingency tables were made, dividing predictive and reading proficiency scores in 3 parts: scores below the 33th percentile, scores between the 33th and the 66th percentile, scores above the 66th percentile. The chi-square values, computed on the contingency tables, showed that the prerequisite tests predict particularly well reading speed. The chi-square values resulted significant for the following variables: the two tests of visual analysis, one visual global identification test, the visual-verbal integration test and a visual span test.

With another series of investigations, Cornoldi and Tressoldi (Cornoldi, Tressoldi, & Morini, 1988; Tressoldi, 1989; Tressoldi, Vio, & Maschietto, 1989; Tressoldi, Vio, Nicotra, & Calgaro, in press) searched for other variables specifically related to reading speed and accuracy. In particular, they took into account some tasks related to phonological awareness (PA), such as phonological analysis and phonological blending and contrasted them with tasks related to visual analysis in order to solve the debate on the relevance of visual versus phonological components in reading acquisition. In this way they were also looking for variables detecting decoding skills rather than reading comprehension skills.

The main findings of this research can be summarized as follows:

- in the factor analysis, the variables related to PA were saturated within a distinct factor compared to all other variables related to visual analysis, sometimes together with tasks of verbal memory span (Cornoldi, Tressoldi, Morini 1988);
- using a discriminant analysis, the PA tasks, alone or together with the digit span tasks, identified more than 70% of the children with scores of reading accuracy or speed below the 33rd percentile at the end of first grade. The proportion of subjects with reading comprehension scores below the 33rd percentile correctly identified did not exceed 46%;
- visual variables gave a higher proportion than PA variables of correct identification of subjects considered good readers with scores over the 66th percentile;
- a good level of PA reduces the risk of reading difficulties to below 20% after two years of schooling;
- phonological analysis is more associated to spelling than to reading.

Table 6 gives a general picture of the relationships we found between the different categories of cognitive variables and the three measures of reading (speed, accuracy and comprehension). This picture was better articulated by a series of studies showing the importance of auditory components in learning to read.

Table 6

Relationship between some cognitive skills and reading accuracy, speed and comprehension from: Cornoldi and Pra Baldi (1979), Pra Baldi (1984), Cornoldi and Pazzaglia (1985; 1987), Cornoldi, Tressoldi and Morini (1988)

Cognitive skills	Accuracy	Speed	Comprehension
STM	+	+	+
LTM			++
Visual analysis	+	++	
Auditory analysis	+	++	
IQ			+
Grapheme-phoneme coupling		++	
Linguistic achievement			++
Blending			+

Note. + presence of positive correlations; ++ presence of strong positive correlations.

In particular, Cornoldi, Tressoldi and Morini (1988) investigated the relationship between reading abilities and some phonological and visual tests of 200 first grade pupils (99 males, 101 female). At the beginning of first grade (September) the following visual and phonological tests were administered: visual research of letters and words (visual tests), aural digit span test, words segmentation test and phonemic blending test (phonological tests). In the following month of January the whole sample was tested with two different writing tests, two reading accuracy and speed tests and a reading comprehension test.

A discriminant analysis was computed on the scores of predictive and learning tests, dividing the distributions at the 33th and at the 66th percentiles. Reading comprehension resulted independent from both visual and auditory skills; phonological readiness tests were good predictors of failure in reading (speed and accuracy) and writing. In fact, the phonological tests predicted 90% of reading failures; visual tests better identified subjects with high reading achievement level. Visual tests identified a proportion of 80% of good readers. Obviously, the accuracy of the predictive power of these subtests may be overestimated by the particular adopted statistical procedure, using discrimination values obtained on a group of subjects for discriminating the same subjects. However, these results are coherent with a large body of evidence present in the literature (e.g. Bradley & Bryant, 1983) and with the results we found in the following studies of this series.

In a second study (on a sample of 80 subjects, 39 males and 41 female) Tressoldi, Vio and Maschietto (1989) investigated the relationship between phonemic awareness and reading during the first year of primary school. Phonemic awareness was evaluated with a words segmentation test and a phonemic blending test administered at the beginning of the school year. Reading tests were administered both at February and at June. The discriminant analyses showed that in February the two phonemic awareness tests identified 75% of subjects with reading disabilities (scores of speed and accuracy below the 33th percentile), and 89% of good readers (scores of speed and accuracy above the 66th percentile). In June, the percentage of disabled readers identified by the two tasks dropped to the 69%, and the percentage of good readers to 54%. In conclusion, the phonemic awareness tests are good predictors of the very first phases of learning to read. After this period of learning the phonemic awareness skill becomes a necessary but not sufficient ability. In fact, it is still predictive of disabled readers only.

Tressoldi (1989) analyzed in two different studies the relationship between reading and writing skills with the word segmentation task and the phonemic blending task taken separately.

In a first study a segmentation test was administered to a sample of 22 first grade children (9 males, 13 female), once a month from October to February. In the same period the subjects' skills to read and write single words were tested. In a second study the phonemic blending test, and the same reading and writing achievement tests were administered to 28 first grade children using the same procedure of the first study. Empirical evidence supports the relationship between the writing tests and the word segmentation test. Reading achievement tests were more correlated with the phonemic blending test.

From a recent longitudinal study by Tressoldi, Vio, Nicotra and Calgaro (in press), a good level of phonemic awareness appears to reduce the risks of reading disabilities below the 20% after two years of schooling. This last study, together with the studies mentioned in the following section, suggests that research on the effects of cognitive enrichment trainings may help to understand the relationship between cognitive prerequisites and reading.

Research concerning the effects of cognitive enrichment before learning to read

Further evidence was collected in a few studies devoted to examine the effects of cognitive enrichment programs in preschool children on subsequent success in reading. These programs were based on the training of abilities assumed to be precursors or early components of reading skills. Cornoldi, Molin, Miato and Poli (1981-1982) studied 56 subjects at risk as regards reading

disabilities, out of a sample of 480 pupils entering the first grade. The perceptual, psychomotor, memory, language and thinking abilities of 28 pupils at risk were trained for four months. At the end of the training period, some reading tests were administered to the 28 trained pupils and to a similar control group. The results (see Table 7) show that training was useful to promote reading speed and accuracy, with a significant difference between experimental and control group in accuracy (number of errors in reading a text) and speed (mean reading time per syllable in cent. of second). The experimental group also had a higher but not significantly different score in the reading comprehension test. In successive research, we focused on the analysis of the effects of programs training on specific components of reading.

Parisi and Cornoldi (1984) successfully trained 9 second grade reading disabled pupils using techniques devoted to automatize phonemic blending abilities. Tressoldi and Nicotra, in an unpublished study, found positive effects on decoding of a program training phonological skills before school.

Table 7

Mean scores in reading achievement tests of the control group (C.G.) and the experimental group (E.G) (Cornoldi, Molin, Miato, & Poli, 1981-82)

Tests	C. G.	E. G.
Accuracy	7.77	5.11
Speed	299.29	181.96
Comprehension	5.07	5.79

In conclusion, empirical evidence shows that the same training program impacts differently on the 3 variables of reading comprehension, speed and accuracy. These results support the hypothesis that at least partially different cognitive abilities are involved in decoding and comprehension skills. Research in this direction should help in developing programs capable to reduce the risk of a reading disability in young children.

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Current theme of research:

Reading comprehension.

Most relevant publications in the field of Educational Psychology:

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Current theme of research:

Scholastic learning disabilities.

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