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**Melissa Scagnelli, Francesco Della Beffa  
& Francesca Santulli**

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# Reading and Comprehension in Adulthood: a Training Programme

Melissa Scagnelli<sup>1</sup> · Francesco Della Beffa<sup>1</sup> · Francesca Santulli<sup>2</sup>Received: 24 April 2020 / Accepted: 16 June 2020  
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## Abstract

Reading is a complex activity, which combines and exploits different components (visual and perceptive abilities, memory, metacognition, emotional components), evolving and qualitatively changing across development. Research has primarily focused on investigating and teaching—and if necessary re-habilitating—reading skills during development, with a special emphasis on decoding processes and reading aloud. In adulthood, however, reading is generally practiced in the silent mode, with the aim of understanding texts, and these aspects have been devoted little attention, above all in the perspective of improving reading abilities. Given the crucial role of reading for comprehension not only in the academic context but also in everyday life, this gap needs filling. This paper investigates the effects of a training programme, named SuperReading, on the reading and comprehension abilities of adult subjects. The course is focused on silent reading and combines metacognitive training, memorisation techniques, self-empowerment and eye-movement practice to enhance reading effectiveness. After a brief presentation of the course and its crucial components, the paper illustrates a research project, aimed at measuring the effects of the training. It presents and analyses the data gathered on a population of 108 university students, all of them normotypical readers (test group), and compares them with a control group of 88 subjects matched for age and educational level; it then comments on the results, which show significant improvements in the performance of the test group and significant differences with the control group.

**Keywords** Reading · Comprehension · Adulthood · Silent reading · Training

## Introduction

### Theoretical Background

Reading is a unique human ability, which plays a crucial role in the development and functioning of contemporary society (Weiss et al. 2016). This complex ability is normally developed in childhood with great emphasis on the decoding process. Its actual aim, however, is to understand written texts and acquire new information, as is more evident in adulthood.

Despite the initial focus of reading research on accurate decoding abilities, which were almost exclusively considered responsible for good comprehension in the 1950s–1960s (De Beni and Pazzaglia 1995; Andrich 2015), since the 1970s,

research on the complex nature of text comprehension has developed, pointing out that the process of comprehension is not limited to disclosing the literal meaning of a text. Rather, it should be conceived as a dynamic interaction between textual information and previous knowledge of the reader, with the aim of producing a coherent and well-formed semantic representation (Mandl et al. 1984; Kintsch 1998; van Oostendrop and Goldman 1999), which in turn is a fundamental prerequisite for learning and memorisation (De Beni and Pazzaglia 1995). In other words, reading is much more than the mere decoding of graphic signs to be transformed into sounds, and cannot be separated from comprehension. The very term *literacy* includes comprehension, which can be achieved thanks to accurate identification of the words contained in a text, and fluency to allow computation of meaning (Vellutino et al. 2004; Scagnelli et al. 2019).

Different abilities and processes are involved in reading, among them: visual-perceptive abilities, metacognition, working memory and emotional components. In the following paragraphs, these four crucial aspects will be briefly examined, with reference to previous research.

✉ Melissa Scagnelli  
melissa.scagnelli@iulm.it

<sup>1</sup> Department of Humanities, IULM University, via Carlo Bo 1,  
20143 Milan, Italy

<sup>2</sup> University Ca' Foscari, Venice, Italy

It is widely accepted that learning to read involves multiple linguistic, *visual and attentional processes* (Franceschini et al. 2017; Aghababian and Nazir 2000). Natural reading implies active sensory-motor activity where saccadic eye movements subservise visual sampling of the orthographic information (Grainger et al. 2016). From the visual point of view, reading occurs through an alternation of fixations and saccadic movements. Actual perception takes place during fixations, and therefore reading speed is linked to the amount of letters that can be caught in one fixation. The term ‘visual span’ was introduced by O’Regan (1990, 1991) and O’Regan et al. (1983), to indicate the range of letters, formatted as in text, that can be recognised reliably without moving the eyes. The size of the visual span is supposed to be determined primarily by characteristics of early visual processing. Legge et al. (2001) studied the relationship between reading speed and visual span, and proposed that the size of the visual span covaries with reading speed. As a consequence, to improve reading performances, it is important to increase the visual span. This can be obtained with training, for example reading text displayed on increasingly wider columns or using a mask to capture an increasing number of words (Legrenzi 1994; Geiger et al. 1994).

During early development, the ability to process spatial and temporal stimuli predicts future reading skills both in shallow and in deep orthographies, confirming a causal link between early visuo-attentional deficits and future reading difficulties (Peterson and Pennington 2015; Vidyasagar and Pammer 2010; Ziegler et al. 2010; Franceschini et al. 2017). Different lines of evidence implicate vision as a factor influencing reading development. For example, Mason and Katz (1976) found that good and poor readers among 6th-grade children differed in their ability to identify the relative spatial position of letters. Different visual search and covert orienting tasks have shown that difficulties in rapid orienting of the attentional spotlight can be considered core deficits in dyslexia (Ziegler et al. 2008).

*Metacognition*, or the cognition of cognition (Flavell 1979), seems to play a crucial role in reading, as its various components have proved to be involved in the absorption and processing of meaning. Numerous researchers emphasise the importance of metacognitive abilities in the learning process and for the development of various academic competences (Pressley and Gaskins 2006; Hacker et al. 2009; Williams and Atkins 2009; Vanderswalmen et al. 2010; Scagnelli et al. 2018; Cornoldi 1995; Albanese et al. 2003). In particular, besides and beyond their fundamental role for academic success, metacognitive abilities have proved crucial in promoting strategic reading and comprehension processes. Their role at different stages of the reading process has been extensively investigated, emphasising the importance of a few crucial factors: activation of previous knowledge, creation of connections between new content and previous knowledge, discrimination between salient and non-salient information,

activation of text-adequate strategies, self-monitoring, and self-evaluation (Efklides 2006; Law et al. 2008; Kostons and Van der Werf 2015; Scagnelli 2018; Santulli and Scagnelli 2019). Good readers can match the reading input with previous knowledge, anticipate difficulties and the way to tackle them, focus their attention on salient information and memorise it, and continually monitor their performance.

The crucial role of metacognition in the reading process is confirmed by its power to discriminate between good and poor readers. The latter have worse metacognitive strategies (Pressley and Gaskins 2006; Efklides 2006; Baker and Beall 2009; Hacker et al. 2009; Williams and Atkins 2009; Vanderswalmen et al. 2010; Scagnelli et al. 2018), while good readers are more proficient at selecting important elements of meaning, reviewing, re-examining difficult passages, integrating text with extra-textual information, and activating inferential processes. On the other hand, poor comprehenders struggle to find out textual inconsistencies, are not able to vary their approach to reading according to their reading aim, and cannot choose the most adequate strategy for different text types and genres (Anderson and Armbruster 1984; Baker and Beall 2009; Rouet et al. 2001).

Although their importance is recognised in research, metacognitive strategies are rarely taught in the classroom (Pressley et al. 1998). In this respect, the study by Boulware-Gooden et al. (2007) provides further evidence to support metacognitive instruction.

All the information necessary to perform cognitive tasks (as reading, learning, problem-solving) is temporary stored in the *working memory* (Baddeley 1990). Therefore, working memory plays a crucial role in the acquisition of knowledge and in the development of new abilities (Alloway et al. 2005; Alloway and Alloway 2010; Yang et al. 2017). Research shows that working memory is a good predictor of reading proficiency (Gathercole et al. 2004; Nevo and Breznitz 2013) and of academic success (Holmes et al. 2009). In adulthood, it influences the development of numerous abilities that are fundamental for effective learning, as note-taking, answering questions and performing tasks (Bacon et al. 2013). Specific training aiming to enhance working memory has positive consequences on reading abilities (Yang et al. 2017), while explicit teaching of memorisation techniques improves academic abilities (Wittrock and Lumsdaine 1977).

The learning process is strongly influenced by *emotional components*, and in particular motivation, anxiety and self-esteem. Their role was first emphasised by Borkowski and Muthukrishna (1992), who demonstrated that success in acquiring effective strategies is accompanied by the ability to connect the learning process with success in the application of the new procedures, thus generating a virtuous circle, which reinforces motivation. Moreover, reflecting on one’s own wishes and goals further stimulates the development of adequate expectations and strategies.

Research has also shown that there is a close and reciprocal relationship between self-esteem and academic success (Kershner 1990; Preeti et al. 2016). Similar results have been obtained for anxiety: positive or negative academic results induce variations in anxiety levels, while anxiety levels in their turn interfere with academic performances (Alam 2013). Anxiety levels also influence motivation (Damer and Melendres 2011).

To sum up, research has widely recognised that reading and comprehension involve different cognitive processes, which may play a more important role than mere decoding. This is especially true in the case of students in their late adolescence or adulthood, when reading is primarily a silent activity, and decoding abilities are no longer taught nor checked.

Against this background, the project developed at the IULM University hinges on a training course, named SuperReading, which combines different approaches and techniques to improve both reading speed and text comprehension in late adolescence and adulthood. This paper focuses on the part of the research aimed at proving the effectiveness of the course.

## The Project

The SuperReading course aims to develop strategies for both better comprehension and higher reading speed in late adolescence and adulthood, working on the silent reading mode.

The course originated in the USA, when Ron Cole, a life coach, developed a syllabus to help managers improve their reading speed and comprehension rates (Cole 2009). Cole obtained remarkable results with his course, which he measured through reading tests administered during sessions. He also noted that dyslexic participants benefited from the course despite their reading difficulties, and even showed higher levels of improvement than normotypical readers. To investigate this circumstance further, the course was duplicated in London, at South Bank University LLU+ (Language and Literacy Unit), with a group of 15 dyslexic participants who confirmed the results obtained in the USA (Cooper 2009a, b). Further research was carried out in London, with similar results (Cooper 2012).

Thanks to an agreement with the promoters of the course, this research group has translated and adapted the course materials to the Italian academic context (Santulli and Scagnelli 2017; Santulli and Scagnelli 2018). To date 25 groups of students have been taught, most of them at the IULM University, where the course is part of the curriculum and awards three credits. Other groups have been taught elsewhere, four of them in other universities, and three with younger participants.

This paper aims to evaluate the effectiveness of the course, answering the following research questions:

1. Does the SuperReading course—combining metacognitive awareness with memorisation techniques, eye training and emotional empowerment—actually promote both reading speed and comprehension in late adolescence and adulthood?
2. The results obtained by SuperReading participants are comparable with those obtained by a control group matched for age and educational level?

Methods and materials for the investigation will be described (§ 2), and data gathered on a population of 108 normotypical readers will be presented and confronted with a control group matched for age and educational level (§ 3). The results will then be discussed (§ 4.), with final considerations on the possible future development of the project.

## Materials and Methods

### Participants

The population considered for this paper comprises 108 participants (normotypical readers). All participants were university students, age range 18–30 (average 21.7). The control group comprises 88 normotypical readers, all of them university students between 18 and 30 (average 21.4). The two groups are therefore matched for age and educational level. With reference to the latter, being all university students, they presumably have similar reading habits (aims, time of reading, motivation) (Smith et al. 1990).

### Design

The research is based on an A-B design (Cooper et al. 2007). To investigate the effectiveness of SuperReading, the performance of participants before and after the course was taken into consideration. Participants were tested using six different reading tests, randomly distributed during sessions. The baseline value was obtained with a test administered at the very beginning of the course, while the final value was obtained with a test administered during the final session, when all techniques had been illustrated and practiced.

### The Training Course

The SuperReading course comprises 9 sessions of 1.5 h each. During the sessions, a coach illustrates the different techniques, checks progress and administers reading tests. S/he also plays a fundamental role in motivating and supporting the participants, creating a cooperative and stimulating environment, and encouraging home practice (Angel and Amar 2005). In the light of the theoretical considerations about reading mentioned above, high emphasis is laid on metacognitive

skills, memorisation techniques and the development of motivation and self-esteem. Reading tests are administered during sessions, to measure reading time and comprehension levels.

To promote *metacognitive abilities*, a choice of strategies are presented and practiced both during sessions and at home. Among them: activation of previous knowledge, formulation of hypotheses on text content on the basis of titles, identification of key concepts on the basis of preliminary questions; pre-view and review. Each topic is illustrated with examples and practice in pairs is encouraged.

To promote *memorisation*, different strategies are illustrated: repetition (which is practiced in pairs during sessions), mind mapping and a specific technique named The Memory Room, which draws on principles developed in Latin rhetoric.

The SuperReading course also focuses on *emotional and motivational components*. Apart from the crucial role of the coach, motivation and self-empowerment are promoted through constant reinforcement of abilities, positive feedback, visualisation techniques and positive affirmations.

Yet, the most innovative and distinguishing feature of the programme is a reading technique, named *eye-hopping*, which requires participants to read texts arranged in parallel columns containing 2–5 words each (with increasing difficulty), ‘hopping’ with their eye from the middle of one column to the middle of the other, with a parallel movement of their forefinger. This technique aims to improve the efficiency of eye movement and increase the visual span. The eye-hopping exercise combines the arrangement in columns with the use of a pointer (normally, the forefinger, or a pen/pencil), which guides the eye movement, helping to reduce regressions and increase the visual span. Constant practice, both during classes and at home, develops the ability to catch increasingly more words at one single glance, thus making reading faster without jeopardising comprehension.

Table 1 offers an overview of the crucial activities performed at each session. Across sessions, the coach promotes motivation, encourages practice and gives positive feedback on the obtained results.

## Materials

It was decided to use testing materials similar to those included in the original version of the course, in order to obtain comparable results.

Each test consists of a 400-word passage followed by 10 open questions. The student reads the text and takes note of the time used, then answers the questions without having access to the text. The text is then read again, and the same questions have to be answered, with no reference to the text nor to the previous answers.

For the Italian version of the course, it was obviously necessary to develop new testing materials. To this end, this

research group first translated the six tests available in English, and then prepared two more tests on a similar topic for each of them. In doing this, passages of similar length were selected, which also matched the originals as much as possible for presence of numbers, proper names, dates etc. All the 18 tests were administered to a small group of PhD students, who also answered a questionnaire investigating self-perception of the difficulty level of each test. On the basis of the results of both tests and questionnaires, one for each topic was selected. The selected tests were then administered to 150 BA students at the IULM University. The analysis of the results showed that the tests had a similar level of difficulty, as the distribution of comprehension scores and reading time was to a good approximation normal, with low standard deviation.

The administration of the tests implies the acquisition of data concerning the following parameters: reading time, percentage of comprehension, and reading effectiveness. Reading effectiveness combines the previous two measures and indicates the percentage of comprehension per minute. On the whole, eight different measures are considered: reading time at first reading (T1), reading time at second reading (T2), total reading time (TRT), comprehension at first reading (C1), comprehension at second reading (C2), reading effectiveness at first reading (RE1), reading effectiveness at second reading (RE2), and combined reading effectiveness (CRE), which is calculated on the basis of TRT and C2. Time is expressed in seconds, while the measure of comprehension indicates the percentage of correct answers (10 percentage points are awarded for each correct answer, 5 for each incomplete answer, 0 if the answer is wrong or omitted). Therefore, while the measure of time is theoretically subject to no limitation, comprehension has a maximum level of 100, which can trigger a ceiling effect. Reading effectiveness is calculated using the following formula:  $RE = [(W * C)/100]/T$ . Results are expressed as number of words correctly understood per minute.

Data analyses were carried out with the IBM SPSS Statistics software (version 26). The research investigated variation in the performance of the test group using the Wilcoxon signed-rank test for all the eight parameters described above. The differences between the test group and the control group were analysed with the Mann-Whitney *U* test. Non-parametric tests were chosen, because the variables under investigation do not meet the assumptions of the corresponding parametric tests (paired *t* test and Anova).

## Results

The differences between first/last test performances are descriptively shown in Fig. 1 (TRT), Fig. 2 (C2), and Fig. 3 (CRE). TRT decreases by 29.5% (on average, readers spend 78 s less on the text), while comprehension increases by 8.3%.

**Table 1** The SuperReading course: an overview

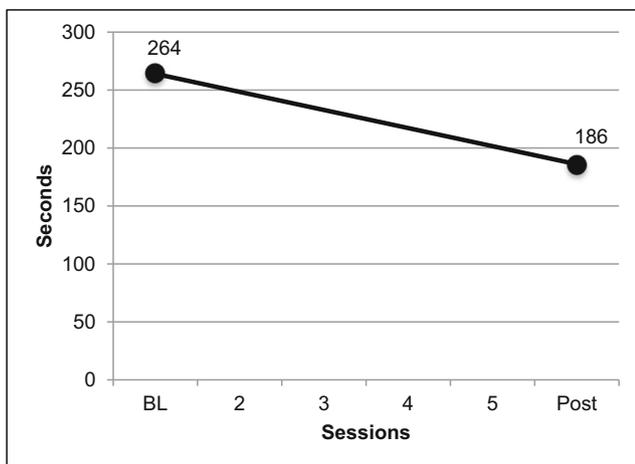
| Session | Aims   | Contents and practice   |
|---------|--|---|
| 1       | To create a positive relation with the coach and a good climate in the classroom, promote motivation and encourage practice aimed to improve eye-motion efficiency<br>To promote a correct saccadic eye movement to reduce regressions | Presentation of the course and of the coach<br>The forefinger as a reading tool<br>Eye-hopping practice |
| 2       | To promote understanding of the role of memory in reading and learning   | Memory Room<br>Pre-viewing  |
| 3       | To promote the acquisition of a specific strategy: pre-viewing<br>To promote the use of repetition as a memorisation strategy  | Integration of pre-viewing, reading and repeating   |
| 4       | To promote awareness of the crucial role of metacognition in reading, comprehension and learning<br>To promote the ability to single out crucial points in a text  | Questions about the title<br>Wh-questions   |
| 5       | To promote the acquisition of reading strategies aimed at increasing reading speed<br>To promote the ability to use mind mapping   | Reading strategies<br>Mind mapping  |
| 6       | To promote integration of the strategies acquired in the previous sessions   | Practice of integrated strategies   |
| 7       | To promote self-esteem<br>To promote awareness of the existence of different approaches to reading<br>To promote the acquisition of strategies for selective reading and global approach to texts                                      | Visualisations<br>Pattern reading   |
| 8       | To promote consolidation of pattern reading strategies   | Pattern reading: advanced practice  |
| 9       | To promote further consolidation of pattern reading strategies<br>To promote self-esteem and motivation to continue practice after the end of the course   | Practice of fast reading and concentration<br>Comments on results                                       |

CRE (which measures the percentage of comprehension in the time unit) increases by 60%.

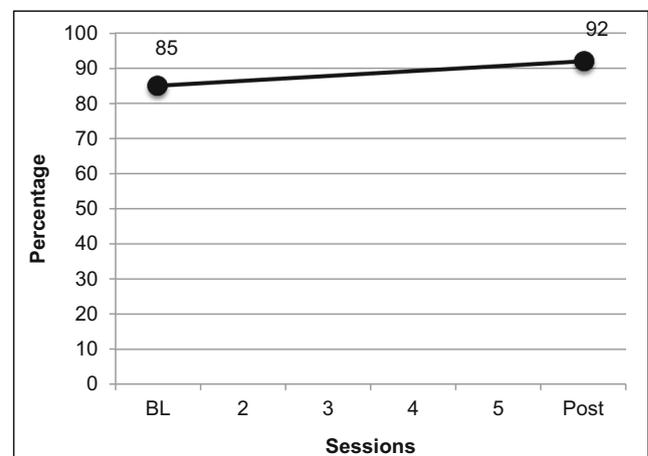
Data concerning all the eight parameters described above have been analysed for statistical significance with the Wilcoxon signed-rank test. Table 2 shows the results of the Wilcoxon signed-rank test, statistical significance, effect size value and median values at first and at last test. All differences are statistically significant, most of them with an effect size

from medium to large (according to Cohen 1988). A lower effect size is measured for comprehension, both at first and at second reading.

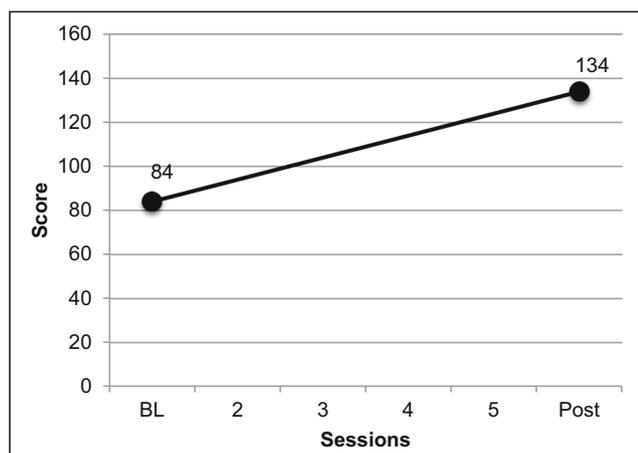
The improvement is so remarkable that it can hardly be attributed to natural development of reading and comprehension abilities thanks to mere practice in relation to attendance of university courses (participants were, as already said, university students). A comparison with the performance of a



**Fig. 1** Average TRT before and after training (test group)



**Fig. 2** Average C2 before and after training (test group)



**Fig. 3** Average CRE before and after training (test group)

control group is needed to rule out this possibility. To this end, a control group, who had not been trained with SuperReading was administered the reading tests, using the same procedure adopted for the test group. Four testing sessions were organised to parallel the schedule of test administration during the course. The first and the last testing sessions occurred at the same time distance as pre-/post-course administrations. However, only a small group of controls (nine subjects) attended all the testing sessions, five attended three sessions and the remaining 74 only the first and the last.

The variations in performance obtained by the test group ( $N = 108$ ) and by the whole control group ( $N = 88$ ) respectively were compared using the Mann-Whitney  $U$  test. The results are shown in Table 3.

The two groups clearly show a different behaviour. Differences are statistically significant for all parameters (mostly with medium-large effect size), but for the two measures of comprehension. This suggests that the behaviour of the test group depends on attendance of the course. The performance of the control group also shows an improvement, but this is significantly lower when compared with that obtained by the test group.

Considering that, besides the effect of mere practice of reading, knowledge of the testing procedure may have

contributed to the improvement obtained by the controls, data obtained by the latter were further analysed to relate them to the number of tests actually performed. As a matter of fact, while the test group comprises participants who performed at least four reading tests during sessions, 74 controls performed only two reading tests. This circumstance, which is the result of the difficulties in recruiting controls willing to follow the whole procedure, may have limited the impact of knowledge of the test procedure in controls. Actually, further analyses have shown that the controls who did four tests performed slightly better than those who did two. For this reason, it was decided to duplicate the comparison between test group and control group, including in the latter only the subjects who did three or four tests ( $N = 14$ ). A preliminary comparison between subjects with 3 tests ( $N = 5$ ) and subjects with 4 ( $N = 9$ ) was carried out, showing that these two groups display a homogeneous behaviour. The performance of the reduced control group ( $N = 14$ ) was then compared with that of the test group ( $N = 108$ ), using the Mann-Whitney  $U$  test. The results are shown in Table 4.

The data confirm the results obtained with the whole control group. As a matter of fact, measures of time, RE2, and CRE are significantly different. The lower effect size may be due to the reduced numerosity of population.

The histograms in Fig. 4 show the distribution of last-first test differences for the measure of total reading time in the test group (right) and in the control group (left). The vertical axis shows the last-first differences, and the horizontal axis shows the relative percentage of subjects (total = 100). Differences below zero indicate an improvement in the reading performance. It is graphically evident that the values obtained by the test group are shifted to the bottom of the figure, showing that a higher number of subjects reduce their reading time, and often this reduction is larger. Similarly, in Fig 5, the histograms reproduce the distribution of variations in final comprehension levels (C2, expressed as a percentage), which are similar for the two groups. Finally, the histograms in Fig. 6 refer to the differences in combined reading effectiveness. In this case, values above zero indicate a global improvement in reading, as they combine time and comprehension levels.

**Table 2** Analysis of differences pre- vs post-training (test group,  $N = 108$ )

| Parameter | Wilcoxon ( $z$ ) | Significance | Effect size | Median BL | Median post |
|-----------|------------------|--------------|-------------|-----------|-------------|
| T1        | - 5.90           | $p < 0.001$  | 0.40        | 143.5     | 119.0       |
| T2        | - 8.35           | $p < 0.001$  | 0.57        | 115.5     | 65.5        |
| TRT       | - 8.42           | $p < 0.001$  | 0.57        | 253.5     | 183.5       |
| C1        | - 5.05           | $p < 0.001$  | 0.34        | 55.0      | 70.0        |
| C2        | - 4.46           | $p < 0.001$  | 0.30        | 85.0      | 95.0        |
| RE1       | - 7.21           | $p < 0.001$  | 0.49        | 87.5      | 138.5       |
| RE2       | - 8.30           | $p < 0.001$  | 0.57        | 167.8     | 348.5       |
| CRE       | - 8.64           | $p < 0.001$  | 0.59        | 79.4      | 124.9       |

**Table 3** Performance of test group ( $N = 108$ ) vs control group ( $N = 88$ )

| Parameter | Mann-Whitney $U$ | Significance | Effect size | Median improvement |            |
|-----------|------------------|--------------|-------------|--------------------|------------|
|           |                  |              |             | Test group         | Ctrl group |
| T1        | 2552.5           | $p < 0.001$  | 0.40        | - 23.5             | + 1.5      |
| T2        | 1314.0           | $p < 0.001$  | 0.62        | - 54.0             | - 9.5      |
| TRT       | 1423.0           | $p < 0.001$  | 0.60        | - 73.0             | - 10.0     |
| C1        | 4220.5           | $p = 0.177$  | 0.10        | + 12.5             | + 10.0     |
| C2        | 4657.5           | $p = 0.809$  | 0.02        | + 5.0              | + 5.0      |
| RE1       | 3218.0           | $p < 0.001$  | 0.28        | + 43.4             | + 12.6     |
| RE2       | 1440.0           | $p < 0.001$  | 0.60        | + 173.2            | + 21.8     |
| CRE       | 1915.0           | $p < 0.001$  | 0.51        | + 42.2             | + 10.3     |

Most controls do improve, but most of them modestly, while most subjects in the test group show improvements with larger last-first differences.

## Discussion

The results of this research show that, given the complex character of reading and comprehension competence, a multifaceted approach makes it possible to develop reading strategies effectively in adulthood. The combination of metacognitive abilities, motivation, memory and eye training yields remarkable improvements, and the analysis of data demonstrates the efficacy of SuperReading in enhancing reading competence, as it reduces reading time, increasing at the same time comprehension and reading effectiveness.

More specifically, the analysis of data concerning reading tests performed before and after the course shows that there is a statistically significant improvement in all considered parameters. In most cases, the effect size varies from medium to large.

Measures of time indicate that participants to the training use significantly less time to read the text, at both first and second reading. Moreover, comparing first and second

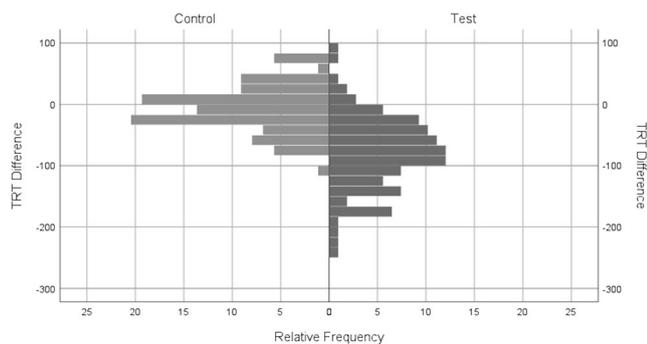
reading time, it emerges that the improvement in T2 is larger. In this respect, it is to be noted that T2 refers to the reviewing phase (second reading), during which the adoption of adequate strategies for spotting relevant information and memorising it plays a fundamental role. In other words, during the review, the decoding process is definitely secondary to the cognitive/metacognitive approach. It is reasonable to conclude that in this particular part of the test, the acquisition of specific strategies has a direct and more dramatic impact on the improvement. Quite obviously, the results obtained in T2 affect TRT values.

Improvements in C1 and C2 are lower, but this can reasonably be attributed to the fact that comprehension is measured as a percentage (maximum score = 100%). The small size effects reflect the limited improvement in these two parameters, conditioned by the ceiling effect. This circumstance is linked with the structure of the test, which sets a ceiling of 100% to the measure of comprehension. This effect is emphasised by the fact that, in both measures of comprehension, participants obtained high levels of performance at first test.

Finally, the results in RE measures give a synthetic picture of the improvements obtained with the course. The value combining first and second reading results (CRE) clearly shows

**Table 4** Performance of test group ( $N = 108$ ) vs reduced control group ( $N = 14$ )

| Parameter | Mann-Whitney $U$ | Significance | Effect size | Median improvement |            |
|-----------|------------------|--------------|-------------|--------------------|------------|
|           |                  |              |             | Test group         | Ctrl group |
| T1        | 316.5            | $p < 0.001$  | 0.32        | - 23.5             | 8.5        |
| T2        | 226.0            | $p < 0.001$  | 0.39        | - 54.0             | - 9.5      |
| TRT       | 199.0            | $p < 0.001$  | 0.41        | - 73.0             | 3.5        |
| C1        | 691.0            | $p = 0.601$  | 0.05        | 12.5               | 15.0       |
| C2        | 712.0            | $p = 0.721$  | 0.03        | 5.0                | 5.0        |
| RE1       | 570.0            | $p = 0.135$  | 0.14        | 43.4               | 14.1       |
| RE2       | 270.0            | $p < 0.001$  | 0.35        | 173.2              | 48.4       |
| CRE       | 337.0            | $p < 0.001$  | 0.31        | 42.2               | 17.5       |



**Fig. 4** Distribution of last-first test differences in test group (right) and control group (left) for total reading time (TRT)

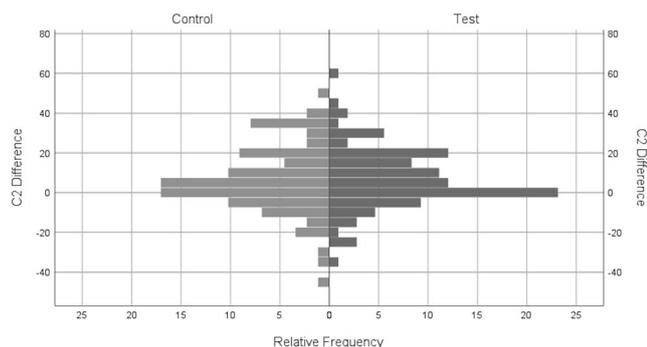
that readers are remarkably more efficient, as they are able to comprehend more in less time.

The comparison with the results obtained by a control group shows that, as for time and reading effectiveness, there are statistically significant differences between the two groups. The differences are not significant only for comprehension. In this case, however, the limited range of variation allowed by the structure of the test is likely to account for the similarity of results obtained by the two groups. Both groups already have quite high levels of comprehension at baseline, and consequently variations are modest.

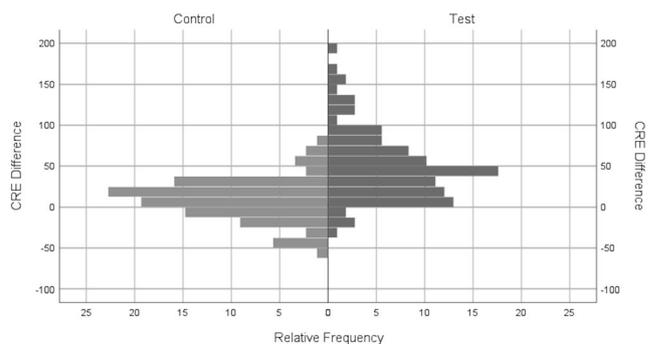
On the whole, the improvement obtained by participants in the SuperReading course cannot be attributed to mere reading practice nor to knowledge of the testing procedure.

The age bracket involved in the project makes it particularly interesting, as young adults are rarely offered training opportunities specially designed for them. On the other hand, the prevalence of silent reading together with the evolution and differentiation of reading aims in adulthood emphasises the role of metacognition to the detriment of mere decoding abilities. Under this perspective, a course hinging on reading strategies and techniques meets the needs of university students, and offers them useful help in their academic career.

It is worth emphasising the strengths of the project, which in our opinion lie in the very structure of the course and its context of administration. The course focuses on different abilities involved in the reading process, which are also useful



**Fig. 5** Distribution of last-first test differences in test group (right) and control group (left) for final comprehension (C2)



**Fig. 6** Distribution of last-first test differences in test group (right) and control group (left) for combined reading effectiveness (CRE)

for learning in general. It is meant for young adults, thus addressing an age bracket usually neglected in research and in intervention on reading. It works on the silent reading mode, which is the most frequent approach to reading in adulthood, and focuses on comprehension, which is the crucial aim of reading from late childhood onwards. The results of this research show significant improvements in the reading performance of a large group of normotypical readers. Data were gathered with a rigorous methodology and using tests that had been validated and were administered in a controlled context. A comparison with a control group shows that the statistically significant improvements obtained by the test group cannot be attributed to mere learning of the test format. In this perspective, the contribution of a recall effect is predictable and to some extent inevitable, but the improvements obtained by the control group turn out to be significantly lower than those of the test group.

There are however some weaknesses that have to be mentioned. Firstly, the control group as a whole did not perform the same number of tests as the test group. A first analysis carried out with a reduced control group more similar to the test group for this aspect has however produced similar results. The limit of this analysis is the number of subjects comprised in the reduced control group. Therefore, the control group needs to be expanded to include more subjects who perform as many tests as the test group. Secondly, a limit of the whole research project lies in the use of testing material that has been developed ad hoc. As mentioned above, it was decided to use testing materials similar to those adopted for the original version of the course, in order to guarantee comparability of the English and Italian results. However, an independent measure is highly desirable, in order to have results based on standardised testing materials that would make it possible to evaluate progress with parameters currently adopted in diagnostic processes. For this reason, another line of research has been opened up (Scagnelli et al. 2018). A group of participants to SuperReading were tested before and after the course with a battery of reading tests designed for adults (Ciuffo et al. 2019). This battery is currently used for diagnosis of SpLD in Italy. Results show statistically significant improvements in the performance of the group both in a silent reading

task and in reading aloud. A control group did show improvement, but significantly less than the test group. The limit of this strand of research lies in the number of subjects involved. However, further data have been gathered to increase both the test population and the number of controls, and they are now under investigation. Finally, the persistence of the improvement needs to be investigated. To this end, a follow-up survey has been planned, aiming to gather reading effectiveness data at least three months after the conclusion of the course. As it is particularly difficult to summon previous participants for further testing, this line of research takes time to be developed. However, the collection of data has already started and will continue, as the permanence of the improvements obtained with the course deserves investigation.

A final point is worth mentioning. The course was actually attended by a larger number of participants, including 222 readers who had been diagnosed with SpLD according to Italian legislation. This group of participants obtained improvements that are similar to—and sometimes higher than—those obtained by the normotypical readers. The group of dyslexic subjects, however, has not been considered for the present study, as the first aim of the whole project is to evaluate the effectiveness of the training on a normotypical population. Yet further research is planned to investigate the behaviour of readers with SpLD, whose presence in the SuperReading classroom represents a further advantage, making the course an inclusive form of support for young adults, university students in the first place.

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**Data Availability** The dataset generated during and analysed during the current study are available from the corresponding author on reasonable request.

## Compliance with Ethical Standards

**Conflict of Interest** The authors declare that they have no conflict of interest

**Ethics approval** This study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments. As IULM University has no ethical committee, the project was submitted to the Ethical Committee of the Università Ca' Foscari in Venice, which approved it last February.

**Consent to Participate** Informed consent was obtained from all individual participants included in the study.

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