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Abstract

Listening to stories and brain processing of narrative material activates many areas devoted not only to the linguistic processing. In this sense, it could be hypothesized that if this activity would be integrated within the school curricula, it could bring benefits in terms of understanding the text as well as in basic essential cognitive dimensions. In a series of studies with different age groups, we investigate the effects of an intensive training in narrative listening, through different tools such as the standardized tests of understanding of the text. We also used a neuropsychological battery investigating basic cognitive processes (Cognitive Assessment System). Results show a significant improvement in all tests for all age groups in the experimental groups, in comparison with the control groups.

Introduction

We can say that every human being is basically a “narrator being”. Narration, considered as the transmission of a content, synthesizes the purely cognitive elaboration of information and the construction of meaning. Condition of the existence of a story is simply the event, something that happened that is shared by the narrator (Jedwloski, 2010). Sharing, in turn, implies the relational and dialogical nature, which is established between the narrator and the listener, or reader. The narrator presents himself and, in his narration, places himself in a situation of vulnerability. The reader, or listener, can therefore feel empathy, identify with or decentralize his or her point of view. In addition, the narrator may or may not satisfy the other. In the first case, the listener manages to frame the story in his constellation of beliefs, patterns and representations; in the second case, the information received can go beyond the threshold of what is conventional or be allusive and this attracts the person because he perceives a clash or *imbalance* (Bruner, 1999). We could say that in a narration there is a silent exchange: while the narrator tells about himself, as in an autobiography, the reader or listener can find themselves in the story, or a different but at the same time interesting opinion, and even a fascinating perspective (Jedlowski, 2013). Human beings constantly create stories and listen to stories and this activity is clearly manifested in the brain, especially in the left hemisphere (Turk et al., 2002): as it has been demonstrated in the exceptional case of *split-brains*, the left hemisphere, in the absence of perceptual information, or in the presence of data provided by the right hemisphere, tries to elaborate a logical thread connecting the events. The need to understand and place in a meaningful framework everything that happens around

us allows us to create an autobiographical memory and consequently to build a Self (Longo, 2010). All this happens through brain modifications and activations that the narrative exposition elicits. Reading activity generates lasting changes in the activation of brain connections detected through functional magnetic resonance imaging (fMRI); immediately after reading a novel, brief changes in the left angular and supramarginal gyrus and the right posterior temporal gyrus were observed, while in the following days there were lasting changes in the bilateral somatosensory cortex (Berns et al., 2013). While the first detected connections were previously delegated to functions such as the perspective taking (which indicates the ability to understand one's own thoughts, feelings and perspectives and those of the others) and the understanding of history, the second ones (whose change is longer) are delegated to a specific function, the "embodied semantics", that is a psychophysiological phenomenon that consists in a hypothesized interaction, at the brain level, between operations of decoding of verbal language and activation of cortical systems of motor regulation (Iachini, 2011).

Reading is much more than just linguistic processing of words. Reading stories triggers many different cognitive mechanisms (Mar 2004). Readers represent what the text describes through mental images.

These representations are also known as "situational models" and incorporate information about space, time, causal relationships, characters (Zwaan, Radvansky, 1998). Therefore, the brain regions involved in understanding the text are not just strictly linguistic, but necessarily various: probably, any network that supports language, memory and even perception plays a role in this process (Mar 2004). In general, reading activates a wide network of areas at the cerebral level (Authors, 2014), operating at different cognitive levels and constituting a real "gym" for cognitive functions, such as mnemonic or emotional functions (Billington J. et al., 2012), executive functions and the speed of information processing (Uchida and Kawashima 2008). Although it is therefore a practice that reveals a lot of potential compared to the benefits that can produce in the brain in both adults and children, an ISTAT analysis published on 13 January 2016 estimates that in our country, in 2015, the "42% of people aged 6 years and over (about 24 million) have read at least one book in the 12 months preceding the interview not just for school or professional reasons" (ISTAT, 2016).

The only age group in which the number of readers exceeds 50% is the one between the ages of 11 and 19, whereas geographically the most critical area is the South, with 28.8% of readers. Among these ones, "strong" and "weak" readers should be distinguished: the former read an average of at least one book a month, the latter at least one a year. In 2015, the 13.7% of the population is among the "strong readers" against 45.5% of the "weak" ones.

In a new survey, published on 27 December 2017 and concerning the year 2016, ISTAT confirms the trend of the previous year. "Readers are still falling, from 42.0% of the population aged 6 and over in 2015 to 40.5% in 2016". (ISTAT, 2017). There is still a great imbalance between North and South of Italy, which seems to be influenced by different cultural and social factors.

The decrease in the number of readers is mainly due to a decrease in the number of "weak" readers, who more easily become "non-readers". The barriers that most often hinder reading seem to be lack of time and limited access to children's books. The first leads some adults to progressively avoid reading, whereas the second, which may or may not be a direct consequence of lack of time, is mainly due to the limited access to places where reading of children's books is fostered. The reading habits learned at this age have a direct correspondence on adult reading habits: most "strong readers" have had parents who, in the first five years of life, devoted time to reading aloud (Duursma, Augustyn, Zuckerman, 2008). The saddest and most worrying fact is that sometimes the school itself makes children lose interest from reading and imposes reading as an compulsory task. Another aspect that seems to influence the number of books read is the socioeconomic status of the family.

It seems that in families with professionals when children are 3 years old they have a cumulative vocabulary of about 1100 words, those from families in the working class know about 750 and the ones from wealthy families have a vocabulary of 500 words or more. In families with professionals, parents heavily invest in their children's language and speaking to them they use a wider vocabulary, consisting of more adjectives and verbs. Parents of wealthy families spend on average less time with their children, use more imperatives with them and impose more prohibitions. It is also believed that children growing up in low-income families have less access to paper books and to moments of reading aloud or shared. The different investment has obvious repercussions on children's literacy and future reading (McCormick, 1977; Duursma, Augustyn, Zuckerman, 2008; Wolf 2009).

This risk factor has been reconsidered by several authors who, shifting the focus from income to the relationship between types of workers and their children, use it to support the importance of the way in which we devote ourselves to pre-school reading (Duursma, Augustyn, Zuckerman, 2008). Systematic exposure to reading aloud can reinforce the development of many of the skills required in early school years. Many studies in literature have led to an increase in both the "active" vocabulary (the terms used in everyday language), and the "passive" vocabulary (all terms whose meaning we know and which we are able to correctly insert in a sentence (Duursma, Augustyn, Zuckerman, 2008).

The ability to understand the text is a factor influencing the development of children's learning and study strategies. During this developmental period, methods of study become a very important means for success at school, also because the commitment required over years grows. However, there are two variables to pay particular attention to: meta-cognition and reading comprehension skills. When reading a text, in addition to the task of decoding the written language, the student must also attribute meaning and significance to it: he must be able to select the most relevant information. This process is carried out through cognitive processes that allow the management of incoming information; processes such as attention and planning play a crucial role in this regard (Authors, 2018). In this contribution, therefore, with a view to promoting good teaching practices, we show the results of four experimental trainings carried out in different primary schools, where we have implemented trainings in reading aloud narrative material, in order to verify the effects of such trainings on students in terms of empowerment of cognitive processes responsible for information management, as well as those deemed necessary for the acquisition of learning at school.

Methods

A total of 165 students from different schools participated in the studies. The groups were created on the basis of both age and the fact that they were in parallel classes, doing the same type of activity during the school year. The selected groups were homogeneous in terms of general cognitive skills (no children reported as disadvantaged), socio-economic background and no psychological and social problems were highlighted. Training has been realized during 60 reading aloud sessions for the experimental group (lasting from 15 minutes - especially at the beginning - up to one hour each, with daily frequency, five days a week, from Monday to Friday). At the beginning, texts were used that were characterized not only by their general brevity, but also by the structure of the period, articulated in short sentences so that the understanding was accessible. Texts with longer semantic units and longer overall duration were progressively used. We proceeded in a similar way with regard to the level of linguistic difficulty, so in the last part of the training we used texts that were not ended in a single day of reading, thus requiring the children to remember the contents of the "previous episode". Before and after the whole training period, both the experimental and the control groups were tested.

Study 1

A total of 42 students (second-year classes) and 38 students (third-year classes). For the second-year classes the experimental group was composed of 22 students (average age 7y4m) and the control group consisted of 20 students (average age 7y6m); in the third-year classes the experimental group was composed of 18 students (average age 8y6m) and the control group consisted of 20 students (average age 8y4m). Before and after the training all subjects were given the INVALSI (INVALSI 2014, INVALSI 2015) test of comprehension of the written text used by the National Institute for the Evaluation of the Education System (INVALSI), a body that is responsible for both detecting the levels of learning in all Italian regions and evaluating the effectiveness of the school curriculum. The analysis of the baselines of the two groups did not reveal statistically significant differences.

Study 2

A total of 29 students took part in Study 2. Fourteen of them were in the experimental group (average age 8y 7m) and 15 in the control group (average age 8y 5m). Before and after the training, both groups were given the PIRLS text comprehension tests (PIRLS-ICONA 2006 and IEA-PIRLS 2011): after reading a text, students were required to answer various questions related to it. The questions in the PIRLS tests are based on four information processing processes: focusing and obtaining the information provided explicitly, making simple inferences, interpreting and integrating concepts and information, examining and evaluating content and formal aspects of the text. The analysis of the baselines of the two groups did not reveal statistically significant differences in the starting point of the two groups.

Study 3

A total of 33 students took part in Study 3. Sixteen of them were in the experimental group (average age 6y 7m) and 17 in the control group (average age 6y 5m). Before and after the training, both groups were given AMOS 8-15 battery tests (Cornoldi et al. 2005), which assesses the subject's ability to learn the contents of a text and to process the main components. The analysis of the baselines of the two groups did not reveal statistically significant differences in the starting point of the two groups.

Study 4

A total of 67 students participated in the study. The experimental group was composed of 33 students (average age 12y5m), whereas the control group was made up of 34 students (average age 12y7m). The tool used to test the students before and after the training is the Cognitive Assessment System (Taddei e Naglieri, 2005). The CAS evaluates cognitive processes in

children and adolescents aged between 5 and 17. The tool is based on Luria's PASS theory (1966, 1973), which considers cognitive functioning as based on four essential processes: Planning, Attention, Simultaneity and Succession (PASS). At the basis of the construction of this tool are studies that propose a multidimensional and dynamic approach to intelligence, based on neuropsychology and cognitive psychology (Das, Naglieri, & Kirby, 1994; Das, 2002; Naglieri & Das, 2005).

The process of Planning is implicit in cognitive control, in the use of processes and knowledge, in the intentionality and self-regulation needed to pursue the desired goal. This cognitive process allows the selection and development of plans and strategies that are necessary to solve tasks and problems. The focus refers to focused and selective cognitive activity as well as to the resistance to distraction. This mental process is involved in the driving response, the basal brain structures allow the body to focus selective attention on a stimulus over time and to counteract the reduction of attention due to the interference of other stimuli.

Simultaneity and succession are essential to make the information operational. Simultaneity is an essential process for organizing information into groups or a coherent whole. Succession is implicit in the use of stimuli organized in a specific serial order. It is activated whenever information is to be remembered or completed in a specific order. The analysis of the baselines of the two groups did not reveal statistically significant differences in the starting point of the two groups.

Results

Study 1

In Figure 1 and 2 the results of the tests of the study 4. The results of the statistical analysis (t test for independent samples on the average increments of the two groups) report a greater increase between the first and second surveys as regards the experimental groups ($t=3.698$, $p<0,001$; $t=3.533$, $p<0,001$).

Figure 1 here

Fig. 1. Effect size (second test session score minus first test session score) of the two groups (second year classes) of Study 1 - INVALSI text comprehension test

Figure 2 here

Fig. 2. Effect size (second test session score minus first test session score) of the two groups (third year classes) of Study 1 - INVALSI text comprehension test

Study 2

Figure 3 shows the results of the tests of study 2. The results of the statistical analysis (t test for independent samples on the average increments of the two groups) report a greater increase between the first and second surveys as regards the experimental group ($t=3,204$, $p<0,01$).

Figure 3 here

Fig. 3. Effect size (second test session score minus first test session score) of the two groups of Study 2 - PIRLS text comprehension test

Study 3

Figure 4 shows the results of study 3. The results of the statistical analysis (t test for independent samples on the average increments of the two groups) report a greater increase between the first and second surveys for the experimental groups in the subtests "Open questions" ($T= 6,072$ $P<0,001$) and total scale ($T=3,815$ $P<0,001$).

Figure 4 here

Fig. 4. Effect size (second test session score minus first test session score) of the two groups of Study 3 - AMOS text comprehension test

Study 4

Figure 5 shows the results of study 4. The graph shows the averages of the increases (or decreases) of the two groups compared. An analysis of repeated measure ANOVA 2X2 (time X groups) shows a statistically significant difference with regard to the interaction time X group ($Df=1,65$ $F=4,372$ $p<0,05$).

Figure 5 here

Fig. 5. Effect size (second test session score minus first test session score) of the five dimensions of the CAS test (PIAN = planning; SIM = simultaneity; SUC = succession; ST = total scale) for the experimental and control groups

Discussion

In each of the 4 studies, results show a significant increase in the performance of the subjects of the experimental groups to the administered tests. In studies 1 2 and 3 we tried to relate the benefits in terms of understanding the text, which the reading training could elicit, trying to test it with similar tasks, but from different batteries. The results are encouraging, especially because the benefits of the same training - which included pre-established reading materials and therefore materials with peculiar characteristics of style and syntax - have produced an improvement in the tests of comprehension of texts fundamentally different from each other: benefits are not limited to come out only through texts similar to those used in the training.

As the literature indicates, the reader constantly needs to mentally simulate what he is reading in order to decode and fully understand the meaning of what he is reading (Gernsbacher, 1990; Graesser, Singer, & Trabasso, 1994; Kintsch & van Dijk, 1978; Trabasso & van den Broek, 1985; van den Broek, 1994; Wagner, Piasta, & Torgesen, 2006; Whitehurst & Lonigan, 1998; Zwaan & Rapp, 2006). The construction of the representation of the text involves a complex set of processes, such as imagining a fact, a movement, an intention and connecting all these various parts within a specific time.

Some of these processes are simple and fast, others require more effort, especially in terms of concentration, working memory, high-level cognitive processes such as planning and recognition of the mental states of others. (van den Broek, Risden, and HusebyeHartmann, 1995; van de Velde, 1989). If therefore it seems quite obvious that a training of this type can strengthen first of all the linguistic skills, and secondly those of comprehension of the text - precisely because the accuracy of reading and comprehension of reading seem to be two separate skills influenced by different groups of skills in children (see also Storch and Whitehurst, 2002) - in the study 4 we tried to investigate the benefits that such training could elicit not only at the level of comprehension of the text, but also of those components which are essential for the comprehension of any text.

Specifically, using the CAS tool, it was possible to detect an increase in performance on the total scale, which consists of all the subscales that specifically investigate the planning processes - which are essential for research and coding of action plans - and the processes of re-assessment of these plans following changes or external variables intervening. They also investigate the processes of simultaneity and succession: the first allows the synthesis of separate elements in an interrelated group, whereas the second one allows the preservation or understanding of a serial organization of events. Even the attention is investigated, that is the ability to focus on a task: along with the other three abilities, it is essential for the management, manipulation and understanding of information in general or in a text. These results suggest that reading practice - whether implemented within school curricula and with a high frequency

- can bring considerable benefits not only, as already observed in previous studies, on faculties such as emotional recognition and theory of mind in general (Authors, 2018), but also as regards the comprehension of the text and the basic cognitive components that imply this and other skills, inducing a benefit at the level of cognitive transverse and transferable empowerment. Although results are consistent between different schools, limitation of the study could arise on a longitudinal perspective: it would be useful, in next studies, to check whether the results are maintained in time, or those reading effects have to be supported by an ongoing training in reading narrative fiction.

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