



A digitalized training to improve reading comprehension through Executive Functions in primary school children

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INTRODUCTION

Reading comprehension is an active process aimed at mentally constructing the meaning of a text, which requires integrating the information gathered from the text with the reader's prior knowledge (Kintsch, 1998). According to DRIVE model (Cartwright & Duke, 2019), text comprehension is based on four constituent elements: the context of the reading, the type of text read, the purpose of the reading and the characteristics of the reader, among which Executive Functions (EF; Diamond, 2013). Considering the cross-cutting nature of reading comprehension and its impact on many school and non-school domains (e.g. Sparapani et al., 2018), it is crucial to intervene early and prevent any difficulties.

Among different types of intervention for reading comprehension, an innovative proposal regards trainings within school setting, embedding EF activities into reading comprehension tasks (Carretti et al., 2017; García-Madruga et al., 2013).

AIMS

- to evaluate the feasibility of the training investigating teachers' feedback (RA1);
- to study the efficacy of a digital training program designed to improve reading comprehension by boosting the main EF in 3-4 graders (RA2)
- to investigate the role of EF in favouring the effects of the training (RA3)

EXAMPLES OF TRAINING ACTIVITIES

To order sequences of images

To understand instructions

To order sequences of sentences

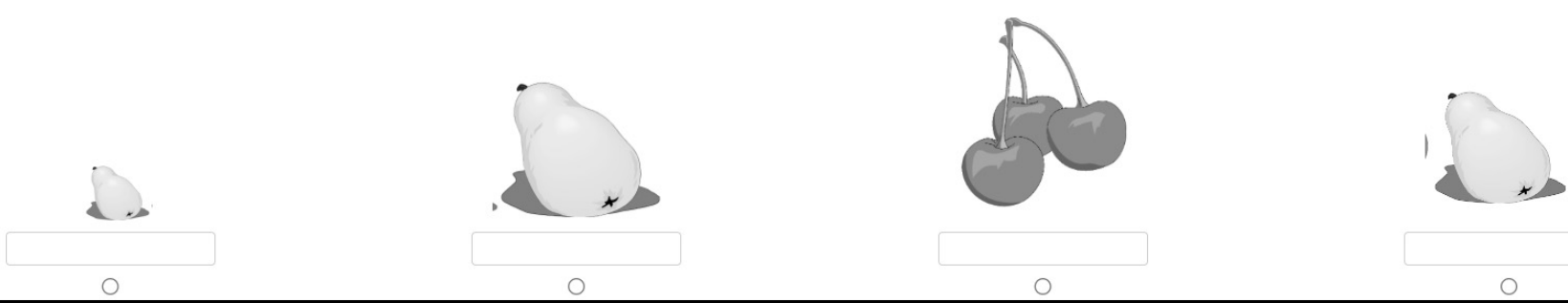
To understand implicit information

To identify inconsistencies in the text

To make inferences

To update during reading

Write in BLOCK and under the SMALLEST PEAR, the NUMBER OF CHERRIES left if you eat one



METHODOLOGY

PARTICIPANTS

- 267 children (Mage=9.11, SD=.63; 122 3rd, 145 4th graders; 116 F, 151 M):
- Experimental group: 159 children (Mage=9.05, SD=.62; 76 3rd, 83 4th; 70F, 89M)
 - Control group: 108 children (Mage=9.21, SD=.62, 46 3rd, 62 4th; 46 F, 62 M)

INTERVENTION

Digital training in order to:

- leverage children's motivation
- introduce standardised video-tutorials reducing the effects of skills, motivation, and knowledge of the teacher conducting the training
- improve graphics
- monitor children's performance during the training.

9 sessions, carried out twice a week for 5 weeks in 1,5 hours sessions.

INSTRUMENTS

Outcome measures

- DARC (August et al., 2006)
- MT Kit Scuola (Cornoldi et al., 2017)
- COTT (Carretti et al., 2017)
- Nonverbal Reasoning Scale 2 of Cattell's Culture Fair Intelligence (Cattell & Cattell, 1965)

Measures of individual differences (selected form TeleFE platform)

- Go/No-Go Task (Inhibition)
- Flanker Task (Interference control and Cognitive Flexibility)
- N-back Task (Working Memory)

STUDY DESIGN

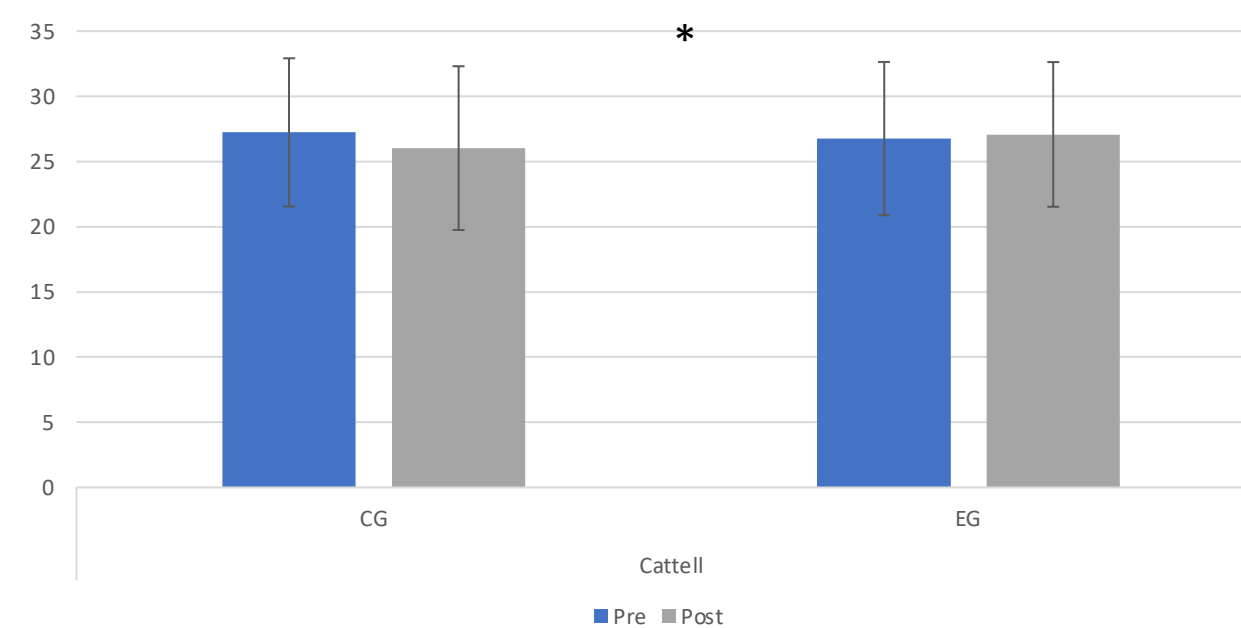
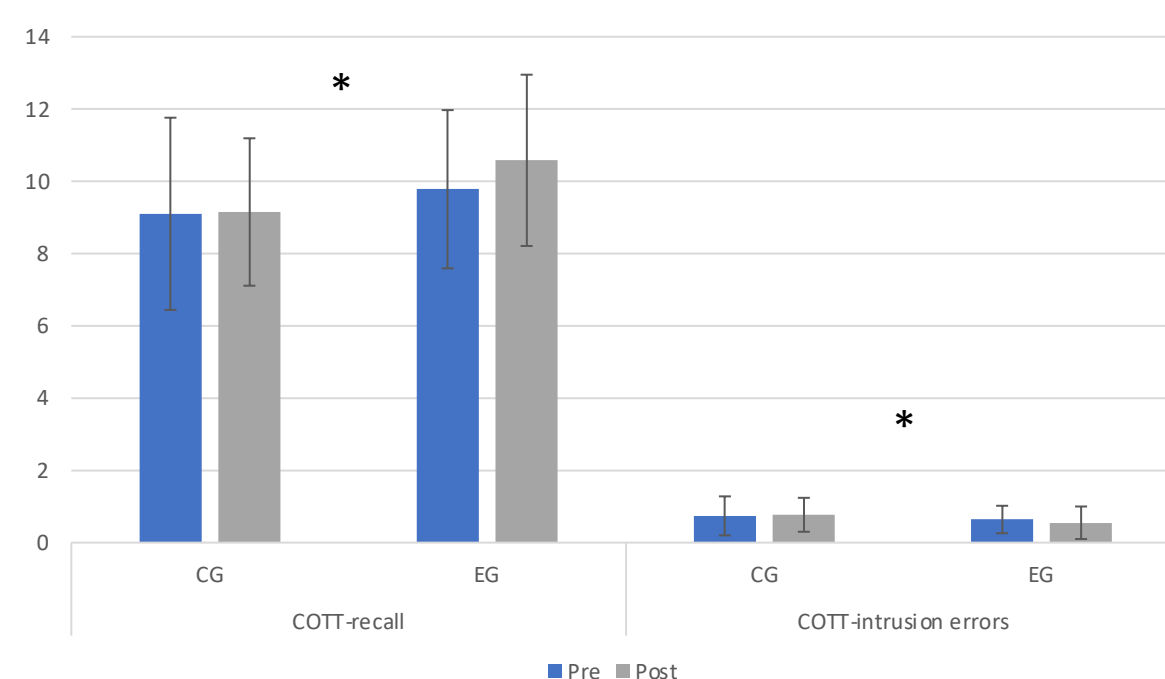
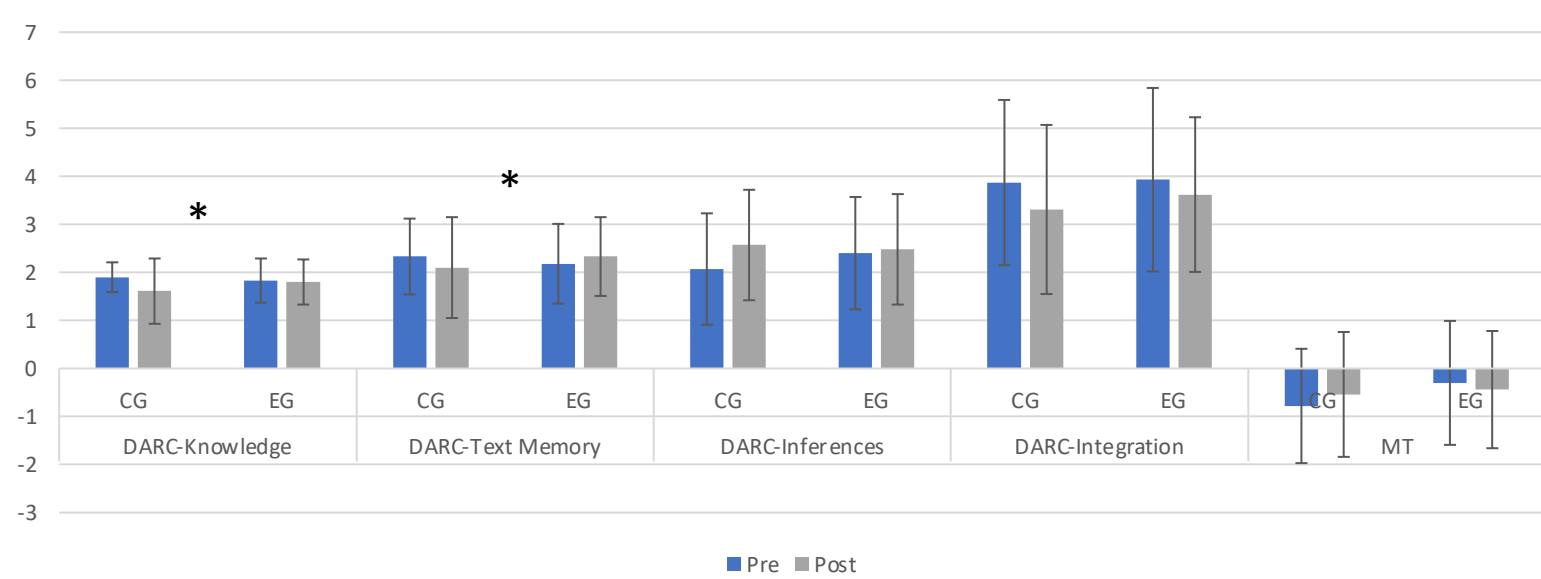
Pre-post test experimental design

RESULTS

R1. Teachers' feedback

POSITIVE ASPECTS ✓	CHALLENGIN ASPECTS ⚠
• Teachers positively rated their satisfaction level of the training (Q1) as well as the utility of the training (Q2). They claimed that they noticed children's improvements in carrying out daily teaching activities after the training (Q3). • Activities' instructions were rated by teachers with the highest level of understandability (Q4). • Teachers reported high levels of children's enjoyment in carrying out the activities (Q5). • The majority of teachers would recommend this training to other teachers (Q6). • All teachers agreed with the use of technological tools to promote reading comprehension (Q10)	• Teachers reported a slight difficulty in fitting the weekly training sessions into the school timetable (Q7) and in obtaining a tablet/PC and headphones to carry out the activities (Q8). • A few connection problems during the performance of activities were recorded (Q9). • Teachers suggested some changes to the training such as further adaptations to the activities (n=1), increasing the graphics (n=2) and adding more sessions/activities (n=3).

R2.



R3.

- The group significantly explained improvements in DARC-Knowledge, DARC-Text Memory, and COTT-Intrusions;
- Age significantly explained changes in COTT-Recall and Cattell correct answers;
- No-Go correct responses significantly explained the reduction of the intrusions in COTT test;
- N-Back correct responses significantly explained the improvement in Cattell test.

DISCUSSION AND FUTURE DIRECTIONS

- Teachers rated positively the training which resulted to be feasible
- In line with previous studies (Carretti et al., 2017; García-Madruga et al., 2013), the training was effective in the experimental group compared to the control group in enhancing the capacity to access prior knowledge by retrieving information from long-term memory (DARC-Knowledge), to remember specific information presented in the text (DARC-Memory), to correctly update words in mind (COTT-Recall) and to avoid the number of intrusions (COTT-Intrusions) and lastly to use non-verbal reasoning skills (Cattell).
 - The improvements with the training in the experimental group compared to the control group did not extend to all measures of reading comprehension but its effects are on text-based measures.
- Among the individual factors explaining the changes, noteworthy are executive processes, which contribute for all measures to the variability explained in the improvement obtained with training. In particular, inhibition significantly explained the reduction in the number of intrusions on the COTT test that occurred from pre- to post-intervention (Borella and de Ribaupierre 2014) and working memory significantly explained the improvement in the Cattell test (Ackerman et al., 2005).
 - Research findings suggested that educational contexts should encourage the use of digital interventions to promote school competences.

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