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Cognitive Training in Childhood: Analysis of Relationships Between Effects and Individual Variables

Entrenamiento Cognitivo en la Infancia: Análisis de Relaciones entre Efectos y Variables Individuales

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Cognitive inhibition (CI) is important for performance in childhood. It is not yet known which variables are linked to the likelihood of optimizing it from interventions. We analyzed the effects of CI training in schoolchildren at 6 and 7 years of age on performance in CI, working memory (WM) and abstract reasoning tasks. We investigated whether variables such as baseline cognitive performance and intervention characteristics are linked to training effects at each age. An experimental design was applied with an experimental group (EG, who received the training) and a control group (CG) by age, with pre and post-test (where tasks were administered to assess CI, WM and abstract reasoning). We worked with a non-probabilistic sample of 65 schoolchildren from two educational institutions in Mar del Plata, Argentina. At 6 years, the EG showed improvements from pre to post-test in WM, Z = -2.99, p = 0.003. At 7 years, the groups differ at post-test in CI, Z = -2.15, p = 0.033, and the GE presented improvements from pre to post-test in abstract reasoning, Z = -2.83, p = 0.005, Only at 7 years the effects are linked to baseline performance on the CI task. The effects are low and differential by age. The development of age-specific assessment and intervention strategies is discussed. Partial evidence is provided for the compensation hypothesis and individual variability.

Keywords: training, cognitive inhibition, executive functions, childhood, individual differences

La inhibición cognitiva (IC) es importante para el desempeño en la niñez. Aún no se conoce qué variables se vinculan con la probabilidad de optimizarla a partir de intervenciones. Aquí se analizaron los efectos de un entrenamiento de la IC en escolares, a los 6 y a los 7 años, sobre el desempeño en tareas de IC, memoria de trabajo (MT) y razonamiento abstracto. Se indagó si variables como el desempeño cognitivo de base y características de la intervención se vinculan con los efectos del entrenamiento, en cada edad. Se aplicó un diseño experimental con un grupo experimental (GE, que recibió el entrenamiento) y control (GC) por edad, con pre y postest (donde se administraron tareas para evaluar IC, MT y razonamiento abstracto). Se trabajó con una muestra no probabilística de 65 escolares de dos instituciones educativas de Mar del Plata, Argentina. A los 6 años, el GE mostró mejoras del pre al postest en MT, Z = -2,99, p = 0,003. A los 7 años, los grupos difieren en el postest en IC, Z = -2,15, p = 0,033, y el GE presentó mejoras del pre al postest en razonamiento abstracto, Z = -2,83, p = 0,005, Solo a los 7 años los efectos se vinculan con el desempeño de base en la tarea de IC. Los efectos son bajos y diferenciales por edad. Se discute sobre el desarrollo de estrategias de evaluación e intervención específicas por edad. Se aporta evidencia parcial a la hipótesis de compensación y variabilidad individual.

Palabras clave: entrenamiento, inhibición cognitiva, funciones ejecutivas, niñez, diferencias individuales

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Executive functions (EFs) constitute a set of cognitive processes involved in goal-directed behavior through the deliberate and effortful control of thoughts, behaviors and emotions (Diamond, 2020). They are important for psychological well-being and quality of life, in that they are fundamental resources for self-regulation (Hofmann et al., 2012; Nigg, 2017). Specifically, they have been linked to various domains, such as emotional regulation, eating habits and academic performance, among others (Cortés Pascual et al., 2019; Diamond, 2020; Dohle et al., 2018; Friedman & Miyake, 2017). Inhibition and working memory (WM) are considered basic EFs for the development and execution of more complex ones, such as cognitive flexibility and reasoning (Diamond, 2020; Gandolfi et al., 2023). WM refers to a capacity-limited system that enables the simultaneous storage and processing of information (Baddeley, 2012). In terms of inhibition, current models identify distinct inhibitory processes. These processes, although they have aspects in common, also present operational functions, developmental trajectories, involvement in other abilities, and involvement in problems, which are specific to each of them and allow them to be distinguished from each other (e.g., Brookman-Byrne et al., 2018; Gandolfi & Viterbori, 2020; Mammarella et al., 2018; Tiego et al., 2018; Zamora et al., 2020). The main operational characteristic they have in common is to control interference generated by trends that are strongly imposed and hinder the achievement of goals (Nigg, 2017). Interference can be linked to environmental stimuli, thoughts, and motor behaviors, being resisted or controlled by perceptual, cognitive, and response inhibition, respectively -the terms may vary by model (Diamond, 2020). Specifically, cognitive inhibition (CI), suppresses or decreases the activation level of mental representations of the WM that are irrelevant to the task. Such information may have been relevant and is no longer relevant (when changing goals) or may be intrusive thoughts that detract attentional resources and hinder processing. In summary, CI enhances processing efficiency by limiting attentional focus to relevant information (Campbell et al., 2020; Hasher et al., 2007).

Different studies suggest that during the primary school years CI is linked to skills identified in the domain of arithmetic (Cragg et al., 2017; De Visscher & Noël, 2014), the learning of counterintuitive concepts in mathematics and science (Mason & Zaccoletti, 2021; Wilkinson et al., 2019) and comprehensive reading (Borella et al., 2010; Demagistri et al., 2012), among others. Moreover, this inhibitory process seems to be especially involved in anxiety control linked to mathematics learning (Mammarella et al., 2018).

Therefore, interventions on CI could have effects on its functioning and other related skills, even preventing future problems in typically developing children (e.g., Bell et al., 2021; Diamond, 2012). This is especially relevant at evolutionary moments of important changes in this and other processes, such as the beginning of elementary school (Aslan et al., 2010; Ganesan & Steinbeis, 2022). In turn, the higher levels of neural plasticity characteristic of this stage increase the probability of generating changes through cognitive interventions. These intervention proposals are framed in the training of EFs, in which a so-called *process-based* approach predominates. These training involve activities that make particular demands on the function to be optimized and increase their level of difficulty according to the participant's progress (Rueda et al., 2021; Smid et al., 2020; Traut et al., 2021).

Despite the importance of CI, until seven years ago, no specific process-based training activities were reported for the school-aged child population. In fact, CI has been studied to a lesser extent compared to other inhibitory processes, such as response inhibition (Aydmune et al., 2022; Hasher et al., 2007).

In recent years, process-based CI training has been developed and tested with school samples (e.g., Aydmune et al., 2018, 2019). In general, intervention effects on activities involving the trained process - i.e., near transfer - and on other distinct, but related skills - i.e., far transfer - have been studied (von Bastian et al., 2022). To analyze the effectiveness of interventions, experimental designs have been implemented, analyzing performance at the group level and comparing an experimental or training group (EG) with a control group (CG). However, individuals respond differently to the same intervention and benefits may vary according to individual differences. Currently, it is proposed that variables such as age and baseline cognitive performance should be analyzed to deepen knowledge about the factors that are linked to the possibility of change (Katz et al., 2021; Traut et al., 2021).

The literature on process-based executive training hypothesizes that younger and lower baseline cognitive performers benefit more from this type of intervention. It is assumed that younger participants would have higher levels of neural plasticity, which would favor change, and that those with a lower baseline cognitive level than their peers would have greater scope for improvement (compared to high performers, i.e., offsetting effects hypothesis; Jolles & Crone, 2012; Traut et al., 2021). However, the evidence linked to these assumptions is still scarce and insufficient (Cao et al., 2020; Traut et al., 2021).

It would also be interesting to identify which specific aspects of the interventions are linked to change. In general, whether a cognitive intervention was effective or not is investigated and, to a lesser extent, specific characteristics that enable change are studied (Green et al., 2019).

Also, the study of the above questions may be limited by methodological decisions. For example, to explore the role of age on training effects, larger samples are needed (Green et al., 2019) to allow, among other analyses, training and comparison of EG and CG for different age groups. This would provide specific evidence on the outcomes of interventions at particular points in cognitive development. However, the few studies in which CI training has been applied in child population have not probed the effects of the training according to age and have worked with small samples (GE of no more than 24 participants; e.g., Aydmune et al., 2018, 2019), which may have prevented the aforementioned analysis. That is, in the cited studies, the participants were schoolchildren whose ages ranged from 6 to 8 years. Had that group of 24 participants been subdivided into groups according to age (e.g., a group of 6-year-old schoolchildren, a group of 7-year-old schoolchildren, and a group of 8-year-old schoolchildren), each group would include only eight cases. These sizes would notoriously affect the results (Moreau et al., 2016; Schmiedek et al., 2021).

In the analysis of baseline cognitive differences linked to intervention effects, there are other difficulties. On the one hand, with regard to CI training during childhood, there is no empirical evidence available on this topic (Aydmune et al., 2022). Moreover, in executive training studies in general, a limitation is observed with respect to the measures and procedures used to assess the effect of baseline cognitive differences. Specifically, the procedure consists of: (a) calculating transfer gains from the performance difference between pre- and post-test assessments and (b) analyzing their correlation with the same pretest measure taken as baseline performance. In other words, the relationship between variables involving in their calculation the same data is analyzed, which may bias the observation of significant correlations (Johann & Karbach, 2020; Traut et al., 2021). Finally, studies differ as to what is meant by baseline cognitive performance: while some consider the process that will be the object of the intervention, others take more general measures (e.g., of intelligence; Traut et al., 2021). Thus, it is important to employ different procedures and variables to deepen knowledge about the effect of baseline cognitive performance and the outcomes of an intervention (Smid et al., 2020; Traut et al., 2021).

Two other aspects debated in relation to the efficacy of executive training refer to the effect of the number of sessions of the intervention program and the effect of performance during training. Regarding the first question, the evidence has not provided a clear answer to this problem. A meta-analysis conducted on studies with samples of participants aged 3 to 12 years reports that the effects of training decrease slightly (small effect size) with the number of sessions (Cao et al., 2020). However, another meta-analysis conducted on research with preschool participants (3 to 6 years old) concludes that the number of sessions has no relationship with the effects of the interventions, but the total time spent on training does (a positive relationship is observed; Scionti et al., 2020).

As for performance during the intervention, studying only the progress of performance throughout the training does not allow us to discern the improvement of the process that is the object of the intervention and to rule out the effects of practice or familiarization with the task. It is then important to probe transfer effects and analyze whether performance in the training activity is linked to the observed effects (Blakey & Carroll, 2015; Rapport et al., 2013).

Therefore, this study aimed to: (a) analyze the specific effects of CI training in schoolchildren, at 6 and 7 years of age, on performance in CI tasks (near transfer), WM and abstract reasoning (far transfer) and (b) investigate whether variables such as baseline cognitive performance and intervention characteristics (number of sessions and blocks performed, initial performance and maximum level achieved) are related to gains after training, in each age group.

In order to understand more specifically the role of age and the particular effects of training in each age group, a EG and a CG were formed for each age (6 and 7 years), expanding the sample with respect to previous studies (Aydmune et al., 2018, 2019) and forming groups according to age. To study the relationship of baseline cognitive performance with training effects (an issue that also distinguishes the present study from the antecedents), different indicators of CI performance were considered (performance in a proactive interference task, considering conditions with and without interference, and intraindividual variability; see description in the Instruments section), as well as other cognitive processes (performance in a WM task and an abstract reasoning task; see Instruments).

We also analyzed whether the number of sessions and blocks performed, as well as performance on the training task (initial and maximum level of difficulty achieved), is linked to the observed effects. We expected to find distinct near and far transfer effects across age groups, as well as various relationships between transfer effects and other variables, such as baseline cognitive performance, training performance, and number of intervention sessions. Following the literature, we expected to find in younger participants a greater benefit from training. We also hypothesized a positive relationship between baseline cognitive performance, intensity and training performance with the observed effects.

Method

Participants

A non-probabilistic convenience sample was selected from two privately managed educational institutions in the city of Mar del Plata, Argentina, that agreed to participate. The initial sample consisted of 101 boys and girls. These children, aged 6 and 7 years, were in the 1st and 2nd years of primary school, in 10 classrooms of these schools. Data from 31 children were excluded if they did not meet any of the following inclusion criteria: non-repeating students, with typical development, not undergoing psychological or psychiatric treatment at the time of the intervention, and with normal or corrected vision and hearing. Finally, four cases were eliminated due to errors in the administration procedure of one of the tasks. Thus, the sample consisted of 65 schoolchildren (age M= 6.52 years, SD= 0.50; girls n= 43, boys n= 22).

Instruments

Pre- and Post-test measures

Proactive Interference (PI) Task for CI Assessment (Aydmune et al., 2020). The task is based on the Brown-Peterson paradigm (Brown, 1958; Peterson & Peterson, 1959) and constitutes an adaptation of the tasks designed by Borella et al. (2013) and Christ et al. (2011). It is constituted by two evaluation blocks of four trials each. Each trial has the following structure: (a) Presentation of a list of four words that the participant must attend to. Each word is exposed for two seconds, visually and audibly, simultaneously. (b) A simple distractor task for 16 seconds, which involves verbally expressing which of two numbers is the larger or the smaller. Its objective is to avoid reviewing the recently presented list. (c) Word recall, requesting the verbal report of the list. The activity is presented through a PowerPoint document and the administrator records the answers. The activity takes approximately seven minutes. The task has acceptable levels of reliability (Cronbach's alpha, $\alpha = 0.7$) and convergent validity, correlating with attention indices, $r = -0.17$, $p = 0.02$, and impulsivity control, $r = -0.18$, $p = 0.049$, from the CARAS-R test (Aydmune et al., 2020).

Correct responses were obtained in each trial (Mammarella et al., 2018). The first three lists in each block (first three trials) contain words from the same semantic category, while the last list is composed of words from another category. According to the literature (e.g., Christ et al., 2011), a worse performance is expected in trials two and three (condition with interference), with respect to trials one and four (condition without interference). This is explained by the interference effect generated by words corresponding to the same semantic category. Likewise, a better performance is expected in trial four, due to the absence of semantic relationship with the previous ones. This would contribute to a decrease in the proactive interference effect, generating an improvement in recall.

In order to achieve adequate performance in trials two and three, it is necessary to eliminate or erase the effect of proactive interference generated by previously learned information, which is achieved through CI. In this study, the existence of significant differences between the conditions with and without interference in each block was verified for the four groups of participants and in the two evaluation instances, adjusting to the expected internal criteria according to the base paradigm (Wilcoxon test, $p< 0.001$ in all cases; see descriptive statistics in Table 1).

Measures of intraindividual variability, such as standard deviation (SD; Betts et al., 2006; Bielak & Anstey, 2019; Boen et al., 2021; Pereiro-Rozas et al., 2012; Zulueta et al., 2019), have been used to assess performance and change in cognitive tasks. Therefore, in this study, SD is also calculated for each participant based on the scores obtained in each block.

The reduction of intraindividual variability implies an improvement in performance in cognitive tasks, so a decrease in the variability of scores in tasks that demand inhibitory control is expected, as the main effect of the training program. In this case, depending on the characteristics of the task, the *SD* of number of correct responses was calculated (Pereiro-Rozas et al., 2012).

Dual Visuospatial WM Task of the Cognitive Self-regulatory Tasks computer battery (TAC, *Tareas de Autorregulación Cognitiva*;; Introzzi & Canet Juric, 2012)

This activity consists of the simultaneous performance of a primary and a secondary task. In the primary task, crosses of different colors are presented sequentially, appearing on individual cells of a 4 x 4 cell matrix. The secondary task, of visuospatial interference, consists (after the presentation of each cross) of marking with the *mouse* the color of the cross on a color palette located to the right of the matrix (the colors on the palette change position from trial to trial). The series of crosses is followed by a recall signal (a sound), which tells the participant to report where each cross appeared, respecting the order of presentation. For this purpose, an empty matrix is displayed in which the corresponding cells must be marked with the *mouse*. The amplitude of the series of elements increases one by one if the participant's execution is accurate. Otherwise, the next trial will display a series of the same amplitude. The activity ends after two consecutive errors in the same series. The WM *span* or amplitude, i.e., the maximum number of items correctly recalled in sequence, is obtained as an indicator. The task has adequate levels of reliability (Cronbach's alpha, for verbal tasks $\alpha = 0.7$, and visuospatial $\alpha = 0.7$) and construct related to changes linked to maturation (with significant differences according to age group, one-factor ANOVAs, $p < 0.05$; Canet-Juric et al., 2018) and convergent (correlating with measures of attention, $r = -0.49$, $p < 0.01$; Canet Juric et al., 2017).

Progressive Matrices Test, Colored Scale (Raven et al., 1991/1993)

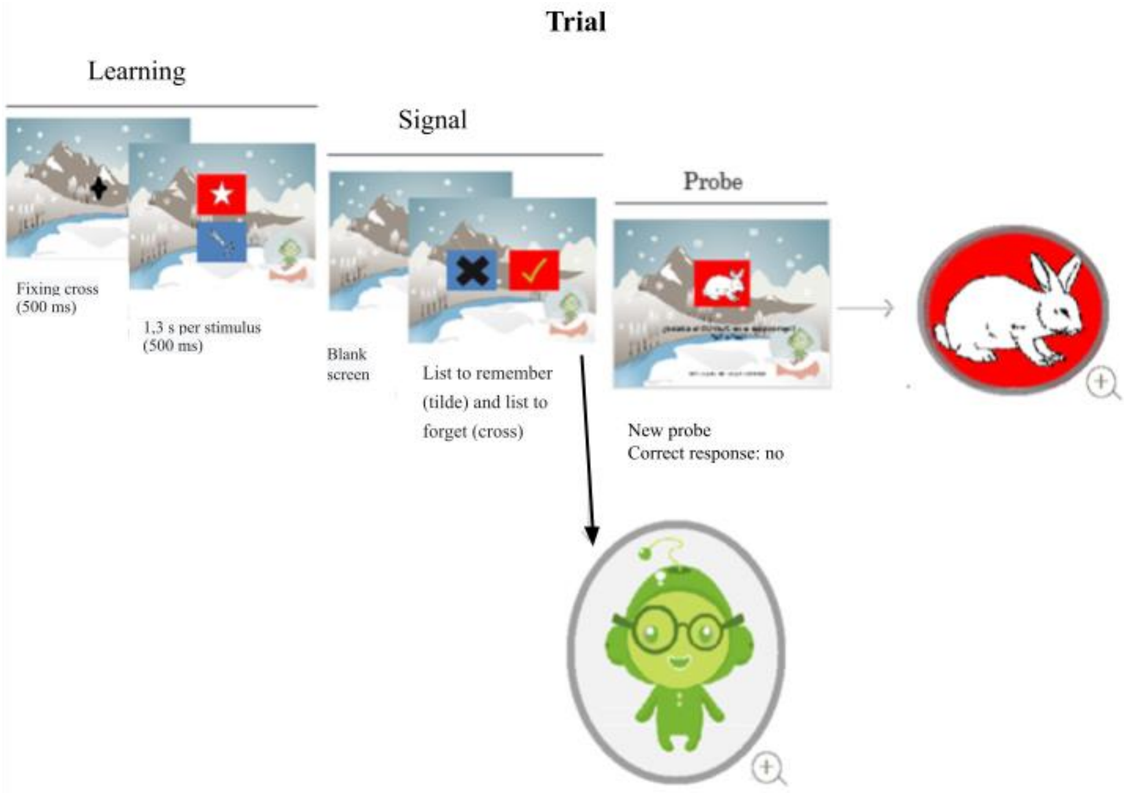
It consists of a non-verbal test for the evaluation of abstract reasoning in children. In this task, 36 problems are presented sequentially and without time limit, which the participant must solve, each one on a sheet of paper. The problems are grouped in three series (A, Ab, and B) that present situations of perceptual relationships. Specifically, each sheet presents an incomplete abstract geometric figure and six smaller drawings below. The participant must identify which of them correctly completes the main figure through the abstraction of a criterion. The total number of correct answers is obtained as an indicator. The instrument has adequate psychometric properties to be administered in the target population-for example, reliability, $\alpha = 0.898$ (e.g., Cayssials et al., 1993), and convergent validity (correlating with fluency, creativity, originality scales, $ps < 0.01$; Krumm et al., 2014).

Tasks proposed in the experimental conditions

CI Training Task "Forming Teams" (*Armando equipos;* Aydmune et al., 2018). This activity has been designed based on an experimental paradigm that combines features of directed forgetting and proactive interference (Oberauer, 2001). Each trial of the task has a structure of three consecutive instances: (a) Learning: the participant is asked to recall two groups of stimuli, one on a red background and the other on a blue one. The number of items in the groups (lists) varies between one and two, so as not to exceed the WM capacity, since the goal is CI training and not WM training. The lists remain on screen for 1.3 seconds per stimulus (e.g., a total of 2.6 seconds if there are two stimuli in the phase).(b) Signal: a signal is presented that informs which of the two lists should be remembered -because it will be relevant in the subsequent recognition phase- and which should be forgotten -because it is irrelevant-. (c) Probe: a stimulus is presented and the participant must indicate whether or not it was part of the relevant list (saying *yes* if it was on the list, or *no* if it was not; see Figure 1). The administrator records the verbal responses. The activity is presented in a PowerPoint document. The stimuli that make up the task, the rules and the instructions were selected for their application in a child population. A character called Little Green (*Verdecito*) was created to accompany the participants throughout the activity. The instructions explain that he and his friends formed two teams, red and blue, to play different games, but they no longer remember which group they belong to. The participant's task is to help them find the team they belong to.

Figure 1

Outline of a Trial of the Cognitive Inhibition Training Task "Forming Teams".



Note: The figure represents a trial of the CI training task "Forming Teams", with the three phases that compose it: learning, signal and probe. Both the image of the character that presents the instruction and accompanies the participant throughout the training (Little Green) and the probe stimulus are amplified.

The test items are of three types: (a) *relevant*, they make up the list to be remembered; (b) *irrelevant*, they make up the list to be "erased" or forgotten; and (c) *new*, they do not make up either of the two lists. The participant is supposed to forget the irrelevant list, i.e., inhibit it, when presented with the cue. If he or she fails to do so, when an irrelevant probe is presented, instead of being rejected, it could be compared with the irrelevant list that has not been eliminated and, therefore, be considered as part of the relevant one. Consequently, more errors are likely to be made on trials with irrelevant probes. The increase of difficulty in the task is achieved in two ways: (a) by decreasing the interval between the presentation of the signal and the probe (the shorter the interval, the shorter the time available to delete the irrelevant list items) and (b) by increasing the percentage of irrelevant probes, which increase the probability of making errors. The activity consists of six levels of different complexity, with blocks of 10 trials each.

Control Tasks. We proposed the lowest difficulty level of the CI training task, congruent blocks of trials of a task based on the Flanker paradigm and the lowest difficulty level of a training task based on the go/no-go paradigm (Aydmune et al., 2019). They are understood as not demanding the target process of the intervention by demanding other inhibitory processes and not increasing its level of difficulty.

Procedure

The activities were carried out within the framework of two research projects approved by the Research Ethics Committee of the Interdisciplinary Thematic Program in Bioethics of the Secretariat of Science and Technology of the National University of Mar del Plata (period 2016-2019). The children gave their assent and their parents/guardians/legal guardians signed an informed consent to be part of the work.

Participants were randomly assigned to one of the experimental conditions, GE and GC, divided by age (6 years: EG n = 15, CG n = 16; 7 years: EG n = 16, CG n = 18). All participants completed two instances of assessment, one pre-test and one post-test, in which measures of CI, WM and abstract reasoning were obtained. Experimental conditions were spread over three months. Sessions of approximately 10 to 15 minutes were proposed, between once and twice a week (6 years: EG M = 8 sessions, SD = 3.18, CG M = 2.19 sessions, SD = 1.28; 7 years: EG M = 5.87 sessions, SD = 1.26; CG M = 2.22 sessions, SD = 1.99).

The training was applied individually using a notebook and an administrator per participant. Trials of the implemented training task were done in a PowerPoint document, being visualized through the notebook screen. The administrator recorded and scored the participants' responses on a printed recording protocol. During training, the passage from one difficulty level to another was adjusted according to the participant's performance as follows: performance in two consecutive blocks belonging to the same difficulty level with at least 80% correct answers involved the passage to a higher difficulty level. Conversely, performance in two consecutive blocks belonging to the same difficulty level with less than 80% correct answers involved the passage to a lower difficulty level. At the beginning of the training, all participants were given the task instructions and a block of two practice trials to ensure understanding of the activity. They then performed at level 1, passing through different levels of difficulty throughout the training. Regarding the maximum level reached, in the 6-year EG, one participant reached level 2, two reached level 3, one reached level 4, two reached level 5, and nine participants reached level 6 difficulty. In the 7-year-old group, one participant reached only level 2, one reached level 3, three reached level 5 and the remaining 11 reached level 6.

The evaluation and training tasks were administered in the educational institutions attended by the students, in classrooms designed for this purpose. The evaluation and training sessions took place for each subject in the same school year.

Data Analysis

The distribution of the variables in each group (age and experimental condition) was analyzed using the Shapiro Wilk test. Given that distributions far from statistical normality were observed ($p < 0.05$) and considering the size of the groups, nonparametric tests were applied in all instances. The initial equivalence of the groups (pretest measures) was tested using the Mann-Whitney U test. To analyze transfer effects, the groups were compared at the posttest using the Mann-Whitney U test, while at the intragroup level, we studied whether their pre- and posttest performances differed using the Wilcoxon test. For the assessment of near transfer, PI task measures were considered and for the assessment of far transfer, WM and reasoning measures were considered. Effect sizes for significant contrasts were calculated using the formula $r = Z / \sqrt{n}$ (the value of Z yielded by the test, over the square root of the total size of observations). Then, gains in transfer measures were calculated by means of the difference between performance on the pretest and posttest. To calculate the relationship of other variables with the gains, Spearman correlation tests were applied.

Results

Table 1 shows the descriptive statistics (M and SD) corresponding to the main performance measures. The initial equivalence of the groups in the pretest is shown in Table 2.

Table 1
Descriptive Statistics for the Pre- and Post-test Measures Related to the Main Performance Variables

Variable		6 years				7 years			
		EG		CG		EG		CG	
		Pre	Post	Pre	Post	Pre	Post	Pre	Post
PITask	S-I B1	6,21 (1,43)	6,53 (1,30)	5,75 (1,06)	6,87 (0,88)	6,64 (1,39)	6,87 (1,09)	7,23 (0,90)	7,47 (0,72)
	C-I B1	3,86 (1,51)	3,87 (1,19)	4,50 (1,26)	4,12 (1,67)	3,78 (1,48)	4,94 (1,39)	4,65 (1,45)	4,94 (1,39)
	S-I B2	7,00 (1,11)	6,67 (1,59)	6,71 (0,99)	7,21 (0,89)	6,94 (1,24)	7,31 (0,70)	7,39 (0,78)	7,33 (0,84)
	C-I B2	4,71 (1,77)	5,13 (1,73)	4,00 (1,92)	5,14 (1,17)	5,69 (1,62)	6,00 (1,59)	5,11 (1,60)	5,72 (1,27)
	VI B1	1,00 (0,44)	1,05 (0,38)	1,00 (0,53)	1,06 (0,34)	1,05 (0,46)	0,90 (0,45)	1,04 (0,41)	1,08 (0,40)
	VI B2	1,00 (0,41)	0,76 (0,44)	1,17 (0,47)	0,90 (0,39)	0,77 (0,41)	0,59 (0,53)	0,95 (0,55)	0,97 (0,56)
WM Task		0,87 (1,30)	2,27 (1,44)	1,44 (1,36)	2,00 (1,50)	2,38 (1,41)	3,06 (1,48)	2,44 (1,58)	2,61 (1,42)
Reasoning		20,67 (4,97)	22,40 (5,11)	17,06 (6,10)	20,25 (6,15)	24,44 (4,83)	27,38 (5,36)	25,0 (3,73)	26,06 (4,62)

Note. S-I = conditions without interference; C-I = conditions with interference; B1= block 1; B2= block 2; VI= intraindividual variability; PI= proactive interference; WM = working memory.
The arithmetic mean and standard deviation are presented in parentheses.

Table 2

Pre- and Post-test, Inter- and Intra-group Comparisons

Variable		6 years								7 years							
		EG vs CG pretest		EG vs CG posttest		EG pre/posttest		CG pre/posttest		EG vs CG pretest		EG vs CG posttest		EG pre/posttest		CG pre/posttest	
		*Z**	*p*	*Z**	*p*	*Z+*	*p*	*Z+*	*p*	*Z**	*p*	*Z**	*p*	*Z+*	*p*	*Z+*	*p*
PI Task	S-I B1	-1,03	0,334	-0,62	0,572	-0,45	0,655	-2,71	0,007	-1,20	0,262	-1,69	0,118	-0,59	0,555	-0,81	0,417
	C-I B1	-0,87	0,400	-0,47	0,654	-0,36	0,720	-1,23	0,217	-1,63	0,118	-0,15	0,901	-1,84	0,065	-1,12	0,259
	S-I B2	-0,86	0,427	-0,92	0,400	-0,63	0,527	-0,79	0,429	-0,99	0,365	-0,26	0,825	-1,51	0,130	-0,30	0,763
	C-I B2	-1,00	0,329	-0,34	0,747	-0,71	0,477	-1,39	0,164	-1,18	0,251	-0,51	0,621	-0,57	0,566	-1,30	0,192
	VI B1	-0,04	0,984	-0,04	0,984	-0,70	0,484	-0,38	0,706	-0,28	0,799	-1,45	0,157	-0,87	0,382	-0,09	0,925
	VI B2	-1,04	0,310	-0,68	0,505	-1,62	0,102	-1,33	0,185	-1,06	0,297	-2,15	0,033	-1,43	0,151	-0,33	0,740
WM Task		-1,16	0,299	-0,35	0,740	-2,99	0,003	-1,32	0,187	-0,67	0,528	-0,36	0,746	-1,62	0,105	-0,09	0,928
Reasoning		-1,66	0,101	-1,23	0,232	-2,12	0,034	-2,52	0,012	-0,16	0,878	-0,55	0,597	-2,83	0,005	-1,42	0,156

Note. S-I = conditions without interference; C-I = conditions with interference; B1= block 1; B2= block 2; VI= intraindividual variability; PI = proactive interference; WM = working memory.
* Mann Whitney U test.
+ Wilcoxon test.

6 Years

Near Transfer

The groups do not differ significantly in the posttest instance on the different measures of the PI task. No significant changes are recorded from pre to posttest, with the exception of the CG in the non-interference condition of block 1 (see Table 2, effect size $r= 0.369$), although this condition would not involve a demand for CI resources (process intended to be trained and evaluated).

Far Transfer

The groups did not differ significantly in the posttest instance in their performance on the WM and reasoning tasks. Both groups significantly improved their performance on the reasoning task (Table 2, effect sizes: EG $r= 0.386$; CG $r= 0.446$). Only EG presented a significant improvement in the WM task (Table 2), with a large effect size ($r= 0.546$).

Variables Linked to

The results of Spearman's correlation tests indicate that pre/posttest EG gains in performance on the WM task are not linked to baseline (pretest) performances on PI, WM or abstract reasoning tasks, nor to the number of blocks or sessions nor to the maximum difficulty level achieved during training -only a marginal correlation is observed between gains in WM and initial performance in training, $r_s(13)= -0.471$, $p= 0.077$-. Positive correlations were observed between training variables (number of sessions and number of blocks performed, $r_s(13)= 0.899$, $p< 0.001$; the maximum level of difficulty reached and number of blocks, $r_s(13)= 0.709$, $p= 0.003$), but this is not related to gains in WM. Finally, initial training performance is significantly linked to pretest performance on the PI task: interference conditions, B1 $r_s(13)= 0.615$, $p= 0.019$, B2 $r_s(13)= 0.602$, $p= 0.023$, in MT, $r_s(13)= 0.551$, $p= 0.023$ and in reasoning, $r_s(13)= 0.625$, $p= 0.013$ (see Table 3 with full correlations in the Appendix).

7 Years

Near Transfer

The results indicate that the groups differ significantly at the posttest instance only in the intra-individual variability in their responses in block 2 of the PI task (Table 2; median effect size $r= 0.369$). At the intra-group level, no statistically significant differences were observed between pre- and posttest performances (Table 2). In the case of intra-individual variability in block 2, the descriptive statistics (Table 1) suggest that in the EG the dispersion decreases, while in the CG it remains stable. In turn, the effect size of the comparison in the EG is small to moderate, $r= 0.253$, while in the CG it is small, $r= 0.078$. However, as mentioned above, the differences are not statistically significant. Finally, in the case of the EG a marginally significant difference is seen in relation to performance in the condition with interference in block 1 of the PI task, with a moderate effect size, $r= 0.327$, while for the CG it is small to moderate, $r= 0.266$.

Far Transfer

The results indicate no differences between groups in performance on the WM and reasoning tasks. Also, only the GE significantly changed its performance from pre to posttest on the abstract reasoning task (effect size, $r= 0.500$; see results in Table 2).

Variables Linked to Earnings

Regarding the possible gains of the EG in their performance on the PI task, only those linked to intraindividual variability in block 2 of the activity correlate significantly with pretest performance in the intraindividual variability in block 1, $r_s(14)= 0.598$, $p= 0.024$, and in the condition with interference also in block 1, $r_s(14)= -0.671$, $p= 0.009$, of the PI task.

Taking into account the direction of the relationships, it is interpreted in both cases that a worse initial performance (i.e., greater variability and lower performance in the condition with interference) is associated with greater gains after the intervention. No significant correlations were observed with training variables (i.e., number of sessions, number of blocks, initial performance). The results of Spearman's correlation tests indicate that gains in performance on the reasoning task are not significantly correlated with initial performance on the PI, WM and reasoning tasks or with training-specific variables.

A significant and positive correlation is observed between the initial performance in training and the maximum level achieved in training, $r_s(14)= 0.522$, $p= 0.038$, that is, a better performance at the beginning would be linked to the achievement of higher levels of difficulty, although this is not related to the gains after the intervention (see Table 4 with the complete correlations in Annex).

Discussion

The main objective of this study was to analyze the specific effects of CI training in 6- and 7-year-old schoolchildren on performance in CI (near transfer), WM and abstract reasoning (far transfer) tasks. In turn, we studied whether baseline (pretest) performances, performance during training, and other characteristics of the intervention are related to the gains observed in each age group. It was hypothesized that the transfer effects would be different in each age group (6 and 7 years), given the assumption that age-related individual differences are linked to training outcomes. Although effects are observed only in some variables, the results obtained show that the effects are not the same for both groups, which justifies the analysis discriminated by age.

As for near transfer, no effects on the specific measures of CI are recorded in 6-year-old schoolchildren, but there are effects in the case of 7-year-old participants. Here, specifically, statistically significant differences are observed between the groups (EG and CG) in the posttest instance in terms of the intraindividual variability of their responses. Descriptive statistics suggest a moderate improvement in the EG and some stability in the CG. A similar pattern is observed in the condition with interference on the PI task. One possible explanation for these results is that the PI task did not have sufficient sensitivity to pick up subtle changes in CI performance, especially in the 6-year-old participants. It is also likely that the training was not adequate to generate changes at the behavioral level in the youngest participants. In this sense, it is important to discuss some issues related to the CI training proposed here. Various attempts have been made to understand whether the training task used is adequate to demand the inhibitory process in question. Let it be said briefly that it has been designed based on an experimental paradigm used in different studies to demand such process (e.g., Comesaña et al., 2017; Oberauer, 2001). Moreover, it meets the internal criteria according to the paradigm (e.g., Aydmune et al., 2018); and performance on this activity is related to performance on tasks demanding linked constructs (Aydmune et al., 2022). However, it is possible that the training may not have been intense and/or long-lasting enough to generate major changes. Other studies of training a single inhibitory process during childhood have proposed a similar (and even smaller) number of intervention sessions-for example, three sessions (Dowsett & Livesey, 2000) and six training sessions (Jiang et al., 2016)-and found close transfer effects. The same applies to other works in which trainings of more than one EF -e.g., four sessions, (e.g., Blakey & Carroll, 2015), six sessions (Aydmune et al., 2021) and seven sessions (Goldin et al., 2013)- have been administered. Now, in the first two cited cases (of trainings of an inhibitory process), response inhibition was trained. Then, CI training could be differentiated by requiring, for example, a different number of training sessions to generate changes. However, as developed below, in this work we did not observe a relationship between the number of sessions or blocks performed during training with the transfer effects, so it is not possible to assert that more sessions will generate greater benefits. However, in the cited studies of training of different EFs, the intervention programs included different training tasks to optimize different executive processes (i.e., CI, response inhibition, WM, planning, among others). This favors the development of a less monotonous training process for the participants (i.e., the probability of loss of motivation for novelty is reduced, since there is greater variability in terms of the proposed tasks). In addition, different executive and non-executive processes are demanded. In this sense, the literature suggests that more intense interventions, offering a wider range of activities and even using different sensory modalities, tend to have better results (e.g., Diamond, 2012; Korzeniowski et al., 2017; Sheese & Lipina, 2011). Thus, it is possible to think that CI training that includes different tasks or different versions of the same task to demand the target process may generate other results. Future research will be necessary in which different modalities of CI training (e.g., of different duration, with different modalities, among others) can be tested in order to understand its scope. On the other hand, it is also possible to argue that the training was adequate, being limited the possibility of CI change through this type of interventions, especially in younger participants. Some recent studies suggest that certain CI mechanisms, such as those that enable targeted and selective forgetting, are not mature at this stage (Kliegl et al., 2018). Then, it is possible that the development and functioning of the process does not admit major modifications at this point in the life course (Jolles & Crone, 2012). In this regard, one of the hypotheses of this work, which assumed that younger people would obtain greater benefits, must be rejected. If CI is not more malleable at this age but is more malleable from the age of 7 years, future research could work with other age groups to analyze at what point in development younger people benefit from a CI intervention, if at all.

Beyond that, it is rescued that the differences in the results at 6 and 7 years could suggest the need for different approach strategies for each age group. This is in line with data available in the literature indicating that changes in CI functioning extend through childhood and adolescence into early adulthood (Kliegl et al., 2018).

In relation to far transfer, although no differences between groups were observed in the posttest instance, differences in performance were found between the pre and posttest that distinguish the experimental conditions in both age groups. In the case of the 6-year-old participants, the EG significantly changed their performance in WM from the pre- to the posttest, while the same was not observed in the CG. On the other hand, at age 7, the change is reflected in the reasoning task. As previously stated, it is possible to argue that training failed to generate major effects. Nevertheless, the observed differences could indicate a differential link of the skills required during the intervention with WM and reasoning. The relationships of EFs with each other and with other more complex skills change throughout the life course (Arán-Filippetti & Krum, 2020; Gandolfi et al., 2023). There is evidence that these processes go through different stages of development and functioning, including moments of undifferentiation and moments of relative independence (Diamond, 2016; Gandolfi et al., 2023; Ganesan & Steinbeis, 2022). In turn, it is understood that the demand for EFs occurs in novel and complex situations, where overlearned responses are insufficient and whose resolution involves effort on the part of the person (Diamond, 2012). In this sense, situations of acquisition of diverse contents and skills (explicit learning) demand EFs, but people can vary the way they perform, employing different strategies that increase or decrease the load of EFs (Gandolfi et al., 2023). For example, early in the process of learning subtraction, schoolchildren may employ the strategy of counting on their fingers. Here, the tendency to count upwards may be imposed (as it is a well-learned procedure), however, it should be controlled by inhibiting the response and then replaced by counting downwards, to perform subtraction (Cragg et al., 2017). Later on, schoolchildren may try to solve this type of situation mentally, which will increase the demand for WM. So, although the Forming teams (*Armando Equipos*) task was not designed with the primary goal of overloading the WM, it could generate an increased demand on this capacity in younger participants. The design of the training task took into account the average number of items that children can keep active in the WM while operating with them. For this purpose, the normative data of the WISC IV Reverse Order Digit Retention subtest obtained in the Argentine population were considered (Taborda et al., 2011). Thus, the number of items in the lists ranges between one and two, presenting no more than three items in total in each learning phase (Aydmune et al., 2018). Even so, it is common to observe, especially in the youngest participants (aged 6 years), a breadth in the WM task of two items or one (as can be inferred from the descriptive statistics obtained in this work). It is possible to think that in this age group the demand for WM was greater (compared to the 7-year-old group), generating in the 6-year-old EG a significant change from pre to posttest in WM (and not in the CG or at age 7). Given that no near-transfer effects were found, it does not seem possible to infer a change in CI that would in turn drive modifications in WM. As mentioned above, further research reviewing training characteristics is needed to elucidate this question.

Regarding abstract reasoning, at 6 years of age, both the EG and the CG show significant changes from pretest to posttest, therefore, this can only be attributed to the participants' own development (e.g., De Alwis et al., 2014). At age 7, only the EG evidences this significant change, making it possible to posit an effect of the intervention beyond particular developmental changes. In this case, it could be argued that certain improvements in the inhibitory process (linked, for example, to the control of proactive interference) could affect performance in abstract reasoning tasks such as those proposed in this study. Different authors posit that better management of interference generated by mental representations would favor working with the relevant information for problem solving in an abstract reasoning task (Sala & Gobet, 2017). The results of antecedent studies, in which CI was trained during infancy and the effects on abstract reasoning were analyzed, are not enlightening in this regard. In a study by Aydmune et al. (2018) no training effects were found and both CG and EG improved their performance from pre- to posttest, similar to what was observed in the present work. Another subsequent study (Aydmune et al., 2019) found only a marginally significant effect of experimental condition (EG *versus* CG) on a single performance variable in an abstract reasoning task. As mentioned in the introduction, these studies worked with groups of participants aged 6 to 8 years, without analyzing differential effects according to age. This could explain the contradictory results of the previous studies. As the data of the present investigation suggest, it is possible that the effects are different according to the age of the participants; specifically, it is possible that after training on CI, no effects on abstract reasoning are observed at 6 years of age, but they are observed at 7 years of age. Perhaps, at this age the resolution of the abstract reasoning task makes greater demands on CI and/or on the different processes and strategies that are put into play when performing the task Forming Teams (*Armando Equipos*). Future research is needed to analyze in detail the relationships between CI, WM, and abstract reasoning task performance at different ages to elucidate these issues.

Likewise, the hypothesis that younger participants would benefit the most would hold true for transfer to WM, but not for reasoning. As discussed below, there are still insufficient studies to understand who benefits most after executive training (Traut et al., 2021), but, crucially, there are no records (to the authors' knowledge) on the differential age-specific effects of CI process-based training. Therefore, future studies will be needed to understand at what age people might benefit most from these interventions

On the other hand, it was hypothesized that intervention gains (both near and far transfer), would be linked to baseline cognitive performance (CI, WM and reasoning), intervention performance (first session performance and maximum level of difficulty achieved), number of sessions and blocks of the training task performed. The gains observed in the 7-year-old EG in their resolution of the PI task are linked to the baseline performance in this same activity. Something to note in this case is that the correlations found are between different variables obtained from this task and not between variables involving the same data for its calculation (Smoleń et al., 2018). This would support the proposition that baseline cognitive performance is linked to gains after intervention, dispelling the idea that the correlation is due to the variables being essentially the same. Specifically and in line with the compensation hypothesis, those participants with lower cognitive performance compared to their peers would benefit more from the intervention (Traut et al., 2021).

Gains in WM of the 6-year-old EG do not seem to be clearly linked to baseline cognitive performance, the number of sessions or blocks of the training task, or the maximum level achieved during the intervention. However, the marginally significant result between baseline training performance and WM gains suggests - in line with what was said in the previous paragraph - that lower performance (in this case in CI) would imply greater benefits on WM after the intervention. This should be corroborated in future studies. For their part, the gains in reasoning of the 7-year-old EG are not related to other variables studied. In summary, the compensation hypothesis presented in the scientific literature on the subject (Smid et al., 2020; Traut et al., 2021) receives partial support here. It should be clarified that, in the field of process-based training of EFs during childhood, the works in which individual differences with respect to baseline performance have been analyzed are heterogeneous, which makes it difficult to understand the compensation effect. Training could increase proficiency in a cognitive skill, reducing the gap between more advanced participants who have already mastered it. But compensatory effects could also be linked to other aspects, such as participants' expectations about how much they will improve with training (whether those with lower initial levels have strong beliefs that an intervention will be beneficial to them, compared to more proficient participants who might feel confident in their abilities). The effects of age on potential compensation have also not been explored, as discussed above (Traut et al., 2021). Finally, there are no specific data on the compensation effect in CI process-based training during childhood (Aydmune et al., 2022) and such effects might vary as a function of the target EF (Traut et al., 2021). This work attempted to make a contribution in this regard, but the results do not allow to be conclusive, so future research will be necessary

In both age groups, it is observed that the intervention variables, such as performance in the first training session and the maximum level achieved, are positively related. That is, those with better initial performance could achieve higher levels of difficulty during training and vice versa. However, this is not clearly linked to the effects of the intervention. This shows the importance of not exclusively considering training performance as evidence of an improvement in the trained process(es) (Rapport et al., 2013).

Finally, some characteristics of the intervention, such as the number of sessions or blocks performed, are not linked to transfer effects. Although some authors suggest that longer interventions would generate greater effects (Scionti et al., 2020), while others assume the opposite (Cao et al., 2020), the results of this study do not clarify the controversy, but the absence of relationships suggests that a greater number of sessions does not necessarily imply effects of a greater magnitude. This is fundamental to evaluate the efficiency of interventions and the possibility of their application in school contexts, where the systematicity of interventions can be hindered by multiple factors (e.g., student absence, suspension of classes, special activities, among others; Canet-Juric et al., 2020).

This work is not free of some limitations that make it necessary to take its results with caution. In the first place, the sample has been selected in a non-probabilistic manner in two privately managed educational institutions, which prevents the generalization of the results to other groups of children -similar and with different characteristics. In this sense, it is important that future studies work with samples with diverse characteristics. As mentioned in the first sections, this study expands the sample used in previous studies (Aydmune et al., 2018, 2019), considers two age ranges (6 and 7 years) and also forms specific groups (EG and CG) for each age, resulting in four experimental conditions (one EG and CG per age). This constitutes an advance with respect to previous studies, with the objective of analyzing the effects of training according to age. Beyond that, future studies could also increase the sample sizes to further increase the chance of identifying transfer effects, especially if they are of moderate to small size (Moreau et al., 2016; Schmiedek et al., 2021). Second, the use of a single task to measure each cognitive process hampers understanding about the extent of transfer. On the one hand, executive tasks are impure, involving different processes in addition to the one they are intended to measure. Thus, for example, a low score does not necessarily imply a low capacity of the process in question, since it may involve the performance of other skills. Thus, it is necessary to use different tasks to assess a cognitive process (von Bastian et al., 2022). At the same time, specific difficulties in measuring inhibitory processes, particularly CI, have been observed in the literature. Different authors raise problems of reliability and validity with this type of task (Friedman & Miyake, 2004). The task reported in this paper is original in the context in which it was applied and has studies of its psychometric properties (Aydmune et al., 2020). Also here, different performance indicators have been used, unlike other studies (e.g., Aydmune et al., 2018), with the purpose of obtaining more information on the performance of the participants in this activity and contributing to the understanding of the transfer of training. However, it is possible to propose in future research the use of other instruments and analyze whether the results are maintained or vary, product, for example, of more precise measurements. In this sense, it would also be important to use other instruments to obtain more information about the effects of transfer on WM and reasoning.

On the other hand, this research has only studied the relationship of training effects with a few variables. This limits a more complete understanding of the individual characteristics that are linked to gains after an intervention. Variables such as motivation and personality traits, among others, would need to be contemplated in future research (Katz et al., 2021).

Beyond these limitations, the work contributes to the field regarding the effects of training based on CI processes at 6 and 7 years of age. Although the effects found are low, they are different according to the age group, which contributes to the study of the development and plasticity of EFs (especially of the CI), fundamental processes for daily performance during childhood (Cortés Pascual et al., 2019; Diamond, 2020). Perhaps future studies in this line will lay the groundwork for a differential approach (assessment and training) according to age and, of course, other variables that were not considered in this research.

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Annex

Table 3

Correlations for measures obtained from 6-year-old participants in the EG.

			1	2	3	4	5	6	7	8	9	10	11	12
gainings	1.WM gainings													
	VI B1	*r*+	0,400											
Pretest		*p*	0,152											
	3.VI B2	*r*	0,176	-0,201										
		p	0,530	0,492										
	S-I B1	*r*	-0,424	0,280	-0,									
		p	0,130	0,332	0,384									
	C-I B1	*r*	-0,442	-0,274	-0,153	0,168								
		p	0,113	0,342	0,601	0,567								
	S-I B2	*r*	-0,242	0,172	-0,042	0,321	0,337							
		p	0,405	0,575	0,885	0,286	0,260							
	C-I B2	*r*	-0,425	0,028	-0,909**	0,543	0,537	0,251						
		p	0,129	0,926	0,000	0,055	0,058	0,387						
	8.MT	*r*	-0,309	0,057	-0,184	0,131	0,087	0,327	0,078					
		p	0,262	0,845	0,511	0,655	0,768	0,254	0,792					
	Reasoning	*r*	-0,274	0,259	-0,417	0,523	0,289	0,482	0,433	0,717**				
		p	0,323	0,371	0,122	0,055	0,317	0,081	0,122	0,003				
	10.Qty. Blocks	*r*	-0,240	0,171	0,245	0,417	0,264	0,257	0,098	-0,074	0,145			
Training		*p*	0,389	0,559	0,379	0,138	0,362	0,375	0,739	0,792	0,606			
	11.Qty. Sessions	*r*	-0,288	0,150	0,335	0,248	0,046	0,080	-0,085	-0,164	0,001	0,899**		
		p	0,299	0,957	0,223	0,393	0,876	0,787	0,773	0,558	0,997	0,000		
	12.Max. level	*r*	-0,067	0,262	-0,100	0,415	0,551*	0,263	0,399	0,158	0,549*	0,709**	0,469	
		p	0,813	0,366	0,722	0,140	0,041	0,364	0,157	0,573	0,034	0,003	0,077	
	13.Initial training	*r*	-0,471	-0,213	-0,478	0,302	0,615*	0,229	0,602*	0,551*	0,625*	-0,076	-0,207	0,405
	disemp.	*p*	0,077	0,466	0,072	0,295	0,019	0,431	0,023	0,033	0,013	0,788	0,459	0,134

$^{+}$Spearman's Rho. Level of significance (bilateral).05. *$p<0.05$, **$p<0.01$, *** $p<0.001$.

Note: S-I = conditions without interference; C-I = conditions with interference; B1 = block 1; B2 = block 2; VI = intra-individual variability; WM = working memory; Qty = quantity; Max. level = maximum level achieved.

Table 4

Correlations for measures obtained from 7-year-old participants in the EG.

			1	2	3	4	5	6	7	8	9	10	11	12	13	14
gainings	1. gainings	r^{+}														
	C-I B1	p														
	VI B2	r	-0,559*													
		p	0,038													
	3. gainings	r	0,052	-0,076												
	Reasoning	p	0,860	0,780												
	S-I B1	r	-0,277	0,207	0,188											
		p	0,338	0,477	0,521											
	C-I B1	r	-0,671**	0,427	0,172	0,651*										
		p	0,009	0,127	0,557	0,012										
	S-I B2	r	0,047	0,237	0,016	0,	0,300									
		p	0,874	0,377	0,952	0,083	0,298									
	C-I B2	r	0,069	-0,311	0,354	0,693**	0,419	0,558*								
		p	0,814	0,242	0,179	0,006	0,136	0,025								
	8. VI B1	r	0,598*	-0,306	0,020	0,159	-0,472	0,036	0,261							
		p	0,024	0,287	0,945	0,587	0,088	0,903	0,368							
Pretest	9.VI B2	r	0,179	0,415	-0,077	-0,543*	-0,292	-0,253	-0,683**	-0,077						
		p	0,541	0,110	0,777	0,045	0,310	0,344	0,004	0,794						
	10.WM	r	-0,089	-0,115	0,193	-0,230	-0,135	-0,396	-0,396	-0,204	0,153					
		p	0,762	0,672	0,475	0,428	0,646	0,129	0,129	0,484	0,572					
	11.Reasoning	r	0,072	0,081	-0,124	0,253	0,030	0,389	0,095	-0,020	-0,148	-0,099				
		p	0,807	0,767	0,647	0,382	0,920	0,136	0,726	0,945	0,584	0,715				
	12.Qty. Blocks	r	0,042	-0,204	-0,009	- 0,161	-0,245	0,113	-0,123	0,116	0,133	-0,080	-0,015			
		p	0,887	0,448	0,973	0,555	0,361	0,665	0,368	0,668	0,611	0,761	0,954			
	13.Qty. Sessions	r	0,134	-0,117	-0,251	-0,070	-0,335	0,223	-0,344	-0,032	0,266	0,366	0,320	0,341		
		p	0,648	0,666	0,349	0,797	0,204	0,390	0,176	0,908	0,302	0,149	0,211	0,196		
	14.Max. level	r	0,208	-0,356	0,417	0,346	0,182	0,353	0,680**	0,027	-0,289	-0,180	0,264	0,177	-0,263	
		p	0,476	0,176	0,108	0,225	0,534	0,180	0,004	0,928	0,277	0,505	0,323	0,512	0,325	
	15.Initial	r	0,191	0,077	0,359	0,403	0,202	0,399	0,437	-0,071	-0,004	-0,162	0,366	-0,211	-0,398	0,522*
	training disemp.	p	0,514	0,776	0,173	0,153	0,488	0,126	0,090	0,809	0,989	0,548	0,164	0,432	0,127	0,038
Training																

$^{+}$Spearman's Rho. Level of significance (bilateral).05. *$p<0.05$, **$p<0.01$, *** $p<0.001$.

Note: S-I = conditions without interference; C-I = conditions with interference; B1 = block 1; B2 = block 2; VI = intra-individual variability; WM = working memory; Qty = quantity; Max. level = maximum level achieved.