

Original Article

# Development of an online cognitive training program for healthy older adults: an occupational therapy intervention<sup>1</sup>

*Desenvolvimento de um programa de treino cognitivo online para idosos saudáveis: uma intervenção da terapia ocupacional*

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## Abstract

**Introduction:** Based on natural aging and its characteristics regarding cognition and the specificities of Occupational Therapy, cognitive training is a health promotion strategy used to favor engagement in occupations and, mainly, improve or maintain cognitive skills, which may decline with aging. **Objective:** To describe an on-line cognitive training program regarding its format and composing activities, as well as to analyze the perceptions of the participating older people and students involved in its development. **Method:** This is an exploratory qualitative study. Cognitive tasks were distributed in 24 individual, multidomain, online training sessions lasting 90 minutes each. Activities with pencil and paper were used, and the intervention was adapted and graded according to the rhythm of the participants. The 21 older people who received the training were evaluated pre and post-intervention using semi-structured interviews, and field diaries were prepared. **Results:** The older participants reported having made use of different internal and external compensatory strategies and indicated improvement in their quality of life perception and occupational performance. The students were able to get involved in the construction of a protocol during the pandemic period, overcoming barriers in the context of remote assistance, which was used to maintain or improve the functional and cognitive performance of the participants, thus favoring healthy aging. **Conclusion:** The results showed that cognitive training had a positive impact on the participants, but there is still a need to refine the protocol to achieve better results. The analysis of the activities conducted proved to be fundamental to systematize the sessions and monitor the performance of the participants.

**Keywords:** Occupational Therapy, Cognition, Cognitive Aging, Elderly.

<sup>1</sup> All ethical procedures in force were complied with, approved by the UFPR Ethics Committee on Research Involving Human Beings under opinion No. 3.756.734, and published in the Brazilian Registry of Clinical Trials (registration number RBR-3bq3gq).

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### **Resumo**

**Introdução:** Com base no envelhecimento natural e suas características no que se refere à cognição e às especificidades da terapia ocupacional, o treino cognitivo apresenta-se como estratégia de promoção da saúde para favorecer o engajamento em ocupações e, principalmente, melhorar ou manter as habilidades cognitivas, que podem sofrer declínio conforme o indivíduo envelhece. **Objetivo:** Descrever um programa de treino cognitivo on-line quanto ao seu formato e atividades que o compõem, bem como analisar as percepções dos idosos participantes e das discentes envolvidas em seu desenvolvimento. **Método:** Estudo qualitativo de delineamento exploratório. Foram elaboradas tarefas cognitivas distribuídas em 24 sessões de treino individual on-line, multidomínio, com duração de 90 minutos cada. Foram utilizadas atividades com lápis e papel e a intervenção foi adaptada e graduada de acordo com o ritmo dos participantes. Os 21 idosos que receberam o treino foram avaliados, pré- e pós-intervenção, por meio de entrevista semiestruturada e foram confeccionados diários de campo. **Resultados:** Após a intervenção, os idosos participantes relataram uso de diferentes estratégias compensatórias internas e externas e apontaram melhora na percepção de qualidade de vida e do desempenho ocupacional. As discentes puderam envolver-se na construção de um protocolo de treino cognitivo durante o período de pandemia, com superação de barreiras no âmbito do teleatendimento, buscando através dele favorecer o desempenho funcional e cognitivo dos participantes para o envelhecimento saudável. **Conclusão:** Os resultados apontaram efeitos positivos do treino cognitivo para os participantes, mas ainda há necessidade de refinamento do protocolo para se atingir melhores resultados. A análise das atividades aplicadas mostrou-se fundamental para sistematizar as sessões e acompanhar o desempenho dos participantes.

**Palavras-chave:** Terapia Ocupacional, Cognição, Envelhecimento Cognitivo, Idoso.

## **Introduction**

Aging is a dynamic and progressive process that brings with it countless morphological, functional, biochemical and psychological changes (Netto, 2017). Cognitive functions also undergo changes in the common process of maturity. Part of these changes happen in older adults, even if healthy, since they may have a reduction in the speed of information processing, shortcomings in recent memory and difficulties in reasoning and perception, as pointed out by Pereira (2017).

When the decline in cognitive functions interferes with the elderly's independence and their everyday relationships, quality of life is directly affected. On the other hand, healthy aging and the satisfactory functioning of cognitive functions provide a positive impact on the individual, generating well-being in their daily lives (Brandão et al., 2020).

Measures to delay cognitive decline and improve occupational performance are necessary, such as physical activity, social interaction and, in particular, involvement in activities aimed at cognitive functioning (Mendes et al., 2018). The most common modalities of cognitive intervention are: cognitive stimulation, cognitive training and cognitive rehabilitation. This study addressed a cognitive training.

Golino & Flores-Mendoza (2016) define cognitive training as a method guided by standardized activities and with pre-defined goals that aim to maintain or even improve

the functioning of certain domains. This form of intervention aims to stimulate cognitive abilities, in addition to optimizing and maintaining the functioning of significant domains in the subject's daily activities (Yassuda et al., 2005).

Cognitive training is generally applied to healthy elderly people and can take different formats, according to the different parameters to be considered, such as those cited by Santos & Flores-Mendoza (2017):

- 1) leading modality: individual or group sessions; 2) target-skills: multidomain intervention – designed to stimulate cognitive skills from different domains, or unimodal – when the target skills are part of the same cognitive domain; 3) stimulus format: with pencil and paper or through computerized tasks; 4) cognitive measures: measures can cover the target skills of the intervention (those in which it is intended to intervene) to investigate the effects of proximal transfer (near transfer) or the untrained skills to investigate the effects of distal transfer (far transfer); 5) follow-up: long-term follow-up examinations to verify the temporal durability effects of the intervention (Santos & Flores-Mendoza, 2017, p. 338).

Occupational therapists have the ability to apply cognitive interventions using resources to promote the maintenance of cognition. The main focus of these professionals is to improve patients' skills in performing daily activities (Raymundo et al., 2017). Occupational therapists have a global and integrative view of the subject, including their values, beliefs, habits, occupational roles and skills (American Occupational Therapy Association, 2020). This view, combined with the use of activity analysis, aims to improve the person's occupational performance. Therefore, the demands of the activity are carefully observed to propose ways of adapting or reorganizing them (De Pablo, 2015).

According to the American Occupational Therapy Association (2020), the occupational therapist has competence to perform activity analysis and occupational analysis. The first refers to the observation of the demands of the activity within a given culture, being, therefore, broader and impersonal, while the second observes the individual and their specific reality. From this, the professional can plan and grade activities in a useful way to assist the client (American Occupational Therapy Association, 2020).

Activity analysis is extremely important for understanding the various components involved in activities: what they demand, what skills are needed and their possible meaning for clients, as well as their therapeutic potential. The analysis is used to plan treatment in order to enable clients to re-engage in those occupations that have particular values and meanings, and have the potential to find possible problems of the activity and adapt it according to the needs of the public served (Crepeau & Schell, 2011).

Therefore, to deal with the aging process and the losses inherent to it, it is necessary to carry out a cognitive training analyzed, developed and applied by occupational therapists. This professional will be able to maximize the benefits of this practice, preventing, maintaining or delaying organic and functional changes, since they will take into account the subjectivity of the individual and the interaction between the person, the occupation and the environment, providing an improvement in occupational performance (Maeir et al., 2014).

In this context, the objective of the present study is to describe a cognitive training program regarding its format and activities that comprise it, as well as to analyze the perceptions of the elderly participants and the students involved in its development.

## **Method**

Qualitative study with an exploratory-descriptive design carried out in two stages: description of the program and analysis of semi-structured interviews with the elderly participants and the field diaries of the students involved in its development.

The present study was derived from a more comprehensive research, of a mixed, quantitative and qualitative nature, approved by the Ethics Committee in Research Involving Human Beings on December 10, 2019 under opinion No. 3.756.734, and published in the Brazilian Registry of Clinical Trials (registration number RBR-3bq3gq).

### **Protocol development**

In March 2020, the Federal University of Paraná started to adopt more restrictive measures, planning and executing prevention strategies in relation to the Coronavirus. One of these measures referred to remote work to be carried out by the entire university community.

As activities related to cognitive training were primarily carried out in the physical space of the university, they were also suspended indefinitely. Furthermore, given that the research volunteers were over 60 years of age, therefore, included in the risk group, it was not possible to continue the research project in person. To this end, between March and June 2020, the training sessions underwent adaptations in order to enable remote intervention (online-synchronous). We chose to develop an original structure for the Brazilian context of the year 2020 instead of using protocols available in the literature, which were built in different contexts.

To define the structural aspects of the intervention, a review of studies on cognitive training for the elderly was carried out and the students participated in training for remote cognitive training, which included training in the use of tools for online assessment of cognitive changes, types of care online, in addition to teleconsultation and telerehabilitation tools.

The cognitive training sessions were applied by five occupational therapy students from a university in the south of Brazil: two students from the eighth period, one from the seventh, one from the sixth and one from the third, and guided by a professor of the aforementioned course.

After these steps, the following aspects of the training format and structure were adopted:

- a) We opted for the individual modality of conducting the cognitive training sessions. According to the studies by Santos & Flores-Mendoza (2017) and Golino & Flores-Mendoza (2016), this modality offers an adapted training and eliminates the competitiveness variable, which can be a barrier in group training;
- b) Regarding the target skills, we opted for the multidomain intervention (training), which according to the studies by Yin et al. (2014) and Golino & Flores-Mendoza (2016), have shown better results when compared to unimodal training. In the present study, the multimodal training of cognitive functions focuses on spatial and temporal orientation skills, attention, memory, praxis, planning, reasoning, categorization, language, inhibitory control, cognitive flexibility, visual-motor construction, decision-making, monitoring and creativity.
- c) Tasks with pencil and paper were used. Even though it is an online cognitive training, it was decided to build and adapt tasks with pencil and paper instead of online games

due to possible difficulties of the population. Therefore, all tasks performed during training were performed in front of a camera (webcam);

- d) It was decided to maintain exclusive monitoring of the same occupational therapy student for each elderly person, from the beginning to the end of the sessions, in order to establish a bond and facilitate the implementation of activities;
- e) The intervention was adapted taking into account the rhythm of the participants, in order to avoid fatigue and frustrations;
- f) A progressive gradation of the trained activities was carried out in order to increase the motivation to adhere to the training. The grading was based on the analysis methodology for activities and occupations by Crepeau & Schell (2011).

After defining the structural aspects, general intervention guidelines were established to be followed by the students while carrying out the tasks. These were built based on the theory of cognitive rehabilitation, on the dynamic training model of Togliola (2014) and on Loewenstein's dynamic battery of cognitive assessment for the elderly (DLOTCA-G). To standardize the terms and words used, the authors relied on the Structure of Occupational Therapy Practice: Domain and Process (4<sup>th</sup> ed.) (American Occupational Therapy Association, 2020). The establishment of these guidelines aimed to standardize the application of the intervention, with specific instructions on how to intervene to improve task performance.

1. Levels of mediation: three levels of mediation were stipulated to increase performance in the task: level 1 – instruction (pausely repeating the question/rule); level 2 - feedback (noticing the error) and feedforward (achieving improvement in the future); level 3 - gradation (ways to make the task easier, offer tips/examples and reduce the amount of times);
2. Number of attempts: most tasks had scoring items such as “more than one attempt” or “trial and error”. These were preceded by a set of interventions (mediations) and aimed at verifying task performance and learning;
3. Task patterns: sequential steps were developed for each activity, including time regulation, requirements, expected response time and interruption criteria (mediation).

Finally, a set of tasks was built and analyzed for each cognitive skill to be trained over 24 sessions.

### *Activities and cognitive training*

The activities and games applied were based on the possible functions that suffer decline in aging and the domains evaluated by the ACE-R and DLOTCA-G: attention, categorization, visual-motor construction, creativity, inhibitory control, cognitive flexibility, language, memory, monitoring, spatial and temporal orientation, planning, praxis, reasoning and decision-making.

Activities and games were analyzed based on the analysis methodology for activities and occupations by Crepeau & Schell (2011).

In all, 97 activities were analyzed, being 13 of reasoning, 11 of memory, 9 of language, 9 of spatial orientation, 8 of attention, 8 of visual-motor construction, 8 of praxis, 7 of temporal orientation, 6 of planning, 4 of inhibitory control, 4 of creativity, 3 of categorization, 3 of cognitive flexibility, 2 of monitoring and 2 of decision-making. The following items were analyzed: main function stimulated; secondary stimulated functions;

activity name; duration; activity description; necessary objects and their properties; space demands; social demands; sequence, timing and patterns; necessary skills; necessary bodily functions and structures; security risks; adaptability to promote participation; gradation; punctuation. Table 1 presents a detailed example of the analysis performed.

**Table 1.** Detailed example of the analysis of the activity performed.

<b>Main function</b>	Visual-motor construction.
<b>Secondary functions</b>	Attention and practice.
<b>Activity name</b>	Building the model with shoelace.
<b>Duration</b>	Approximately 20 min.
<b>Activity description</b>	The participant must lace the shoe/sneakers according to the model presented.
<b>Used objects and their properties</b>	Computer or smartphone, shoes/sneakers, shoelaces and side table.
	Objects can refer to everyday activity, past occupational roles or broken occupations.
<b>Space demands</b>	Well lit environment, without noise or great auditory stimuli, with Internet access.
<b>Social demands</b>	The participant is expected to look at the model and thread the shoelace with the least amount of mediation and in the shortest possible time.
<b>Sequence, timing and patterns</b>	1- Observe the model displayed on the screen;
	2- Follow the activity step by step, as shown in the images;
	3- Lace the shoelace on the shoe;
	4- Show the result;
	5- Ask questions and receive correction at the end of the activity.
	The activity lasts approximately 20 min and should take place during cognitive training at the agreed time.
<b>Necessary skills</b>	<b>Motor skills:</b> Alignment, Stability, Positioning, Reach, Tilt, Grasp, Manipulation, Coordination, Moving, Sustaining, Calibration Refinement, Fluidity, Resistance and Rhythm.
	<b>Procedural Skills:</b> Rhythm, Focus, Attention, Choices, Applicability, Manipulation, Inquiry, Initiative, Continuity, Sequencing, Termination, Search/Location, Organization, Reset, Displacement, Errands/Answers, Adjustment and Accommodation.
	<b>Social interaction skills:</b> Approach/beginning, Conclusion/ending, Speech production, Gesticulation, Fluent speech, Movement during interaction, Gaze, Self-positioning, Regulation, Questioning, Replication, Resourcefulness, Expression of emotions, Disagreement, Thanking, Transition, Time Response, Duration, Relay, Language Game, Clarification, Recognition and Encouragement, Empathy, Paying Attention, Appropriation and Benefits.
<b>Necessary bodily functions</b>	<b>Specific Mental Functions:</b> High Cognitive Level, Attention, Memory, Perception, Mental function for sequencing complex movements, Emotional and Experience of self and time.
	<b>Global Mental Functions:</b> Consciousness, Orientation, Temperament and Personality, Energy and Disposition, and Sleep.
	<b>Sensory Functions:</b> Visual Function, Hearing Function, Vestibular Function, Proprioceptive Function, Tactile Function and Sensitivity to Temperature and Pressure.

**Table 1.** Continued...

	- Neuromusculoskeletal and movement-related functions: Joint mobility, Joint stability, Muscle strength, Muscle tone, Muscle endurance, Motor reflexes, Involuntary movement reactions and Voluntary movement control.
	<b>Functions of the cardiovascular, hematological, immune and respiratory systems:</b> Function of the cardiovascular, hematological and immune system, Function of the respiratory system and Additional functions and sensations of the cardiovascular and respiratory systems.
	<b>Voice and speech functions:</b> Voice and speech functions.
	<b>Body structures:</b> Structure of the nervous system, Eyes, ears and related structures, Structures involved in voice and speech, cardiovascular structure, immune and respiratory systems, Structures related to movement, skin structures and others.
<b>Risks for safety</b>	- Embarrassment. - Frustration.
<b>Adaptability to promote participation</b>	- Adjust voice tone; - Give examples of how to do the activity; - Use virtual resources (gifs, videos) for the step by step phase; - Increase the image size; - Use a shoelace looper.
<b>Gradation</b>	Facilitators: Use gifs for the steps; use arrows to indicate the way, number lines and columns; do it together. Challengers: Having time to finish; not allowing trial and error; having different levels of difficulty.
<b>Punctuation</b>	1 - Is unable to reproduce the model; 2 - Reproduces the model connecting only two lines; or reproduces the model by trial and error; uses gifs as mediation. 3 - Reproduces correctly; or connects more than two lines.

Throughout the intervention, the cognitive capacity of the participants and the obstacles of telemarketing were taken into account for the reformulation of the protocol, which underwent the following changes: 1) Exclusion of the activity “Clap the syllabus”: the activity was perceived by the participants and students as superficial, requiring low cognitive effort; 2) The activity “Combining riddles” with answers and the activities that involved drawing in the visual-motor construction sessions were considered by the participants as excessive; then, the number of items was reduced and the instructions were adapted for better engagement. 3) The activities of the reasoning sessions, “perfect fit” and “sequence of letters” were considered difficult by the participants and students, demanding a lot of time to carry out the tasks, overloading the sessions. These tasks were reformulated considering the gradation of the activity analysis to generate greater adherence to the sessions.

Each session began with a didactic explanation about the highlighted function to be stimulated on the day, its description, location of the stimulated areas in the brain and impact on daily life. After that, the activities were explained and performed, only during training hours, accompanied and supervised by the student in charge, and no exercise was applied outside the training time.

At the end of each session, the student responsible for the participant scored the activities according to their respective analysis and wrote their perceptions and the

participants' statements in a field diary shared with the other researchers. Such monitoring was carried out in order to verify the evolution of the elderly and give them feedback.

When necessary, discussions were held with the other students and the teacher with the purpose of dialoguing about the individual and collective process of the intervention group, in addition to aligning the cognitive training protocol with guidelines such as forms of punctuation and divergences in answers.

## **Participants**

Twenty-one elderly people (10 men and 11 women), aged between 61 and 74 years, participated in the intervention. There were no dropouts during the cognitive training. Inclusion criteria were: to be older adults (age  $\geq 60$  years), of any sex, without cognitive deficits, without signs of depression, to know how to read and write, to be interested in and to have available time to participate in the sessions during their duration and to be able to use the digital tools after training was available.

The recruitment of participants took place through publicity in projects of a university in southern Brazil aimed at the elderly public and in the dissemination media of that same university (digital media - e-mail), as well as by indication of the participants themselves. The contact between the interested parties and the researchers took place via e-mail or telephone provided in the disclosure.

In addition, the cognitive training involved the participation of five occupational therapy students from the eighth, seventh, sixth and third periods of the undergraduate course in occupational therapy at a university in southern Brazil, with experience in scientific research and prior knowledge of cognitive interventions.

## **Study procedures**

After structuring the training and analyzing the activities and games, contact was made with the elderly to participate in the study. They were instructed on the research and received training in relation to the videoconferencing platforms to be used, *Google Meet* and *Jitsi Meet* - chosen for presenting the necessary resources for the development of the training (longer free meeting time, possibility of video presentation with quality and without blocking) and accessibility for participants who may have had previous difficulties in using it. Those who agreed to participate in the study signed a Free and Informed Consent Form electronically, through an online form.

The intervention took place individually, following the pre-established schedule, taking into account the speed in carrying out and understanding the tasks and games. The time of each session varied according to individual performance and available connection and was 60 min on average. However, the number of sessions did not change, it remained as planned: 24 meetings twice a week. The participation and performance of each elderly person in the proposed activities were monitored by a student during each session through direct observation, using notes and responses given by the elderly to the exercises.

## **Data collection and analysis**

Data were collected through semi-structured interviews with the elderly participants and recorded in a field diary by the students participating in the development of the



cognitive training program. The semi-structured interview, specially designed for the research, addressed the impact of physical distancing due to the COVID-19 pandemic on cognitive, emotional and social functions, the use of mnemonic strategies, occupational performance and the assessment of structural aspects of cognitive training. The field diary was prepared in a virtual document to record the observed data of each participant during the cognitive training sessions.

It is also noteworthy that the following assessment instruments were applied at the time of pre-training and immediately after training, in the individual mode and online by video call: Geriatric Depression Scale (GDS-15) (Almeida & Almeida, 1999) and Addenbrooke Cognitive Examination-Revised (ACE-R) (César et al., 2017). At the end of the study, each participant received a feedback on their performance in cognitive training. However, the present research proposes to discuss, specifically, the data from the interviews and field diaries.

The interviews and field diaries were evaluated through content analysis (category-thematic) by Bardin (2011) in order to verify the perception of the program by those involved. To ensure anonymity, the names of the participants were replaced by the letter P followed by a number in ascending order according to the sequence of the interviews (P1, P2,...) and the names of the students by the letter M followed by the previously defined order (M1, M2, M3, M4 and M5).

## **Results**

### **Pre-training interview**

From the interview carried out before the cognitive training, it was possible to observe the influence of the COVID-19 pandemic on different aspects of the participants' daily lives. Regarding cognitive functions, forgetfulness and slowness in information processing were reported, as follows:

*I think I am less focused, there are times when there are blanks (P1).*

*It has negative influence because over time we start to have no perspective and then everything is kind of dormant, even cognitive functions. It is as if the brain starts to get a little lazy. So if we do not watch out, those who have a tendency can even get depressed (P4).*

*But of course, there are times when we do not get confused, but it seems like there is so much to think about and I believe this is kind of normal, not just now, but we end up forgetting something from there, something from here (P10).*

In addition, the physical distancing caused by the pandemic was highlighted, which brought different feelings and challenges to participants related to family, friends and social participation as a whole, as expressed below:

*[...] I do not see anyone and I only talk to someone virtually. This for me is a great difficult. The biggest difficulty is that I am a person who was born with a suitcase on my back and [...] my suitcase is creating dust and I am going crazy inside the house (P2).*

*Oh, I used to go out every day, right [...] I used to talk every day, not now [...] I am not doing that anymore so I feel like [...] I am starting to feel the pain in my joints... so that is the difference I am noticing (P6).*

*What I miss is going out, visiting a friend, visiting my family, my daughters who live far away. So you are just talking, talking, but you are not there, right? So I miss this a lot: hugging, caressing, being close to the ones you like (P9).*

Given the circumstances, the participants presented different internal and external compensatory strategies to deal with the changes resulting from functional and cognitive decline, which affect occupational performance, directly influencing quality of life. Study participants used repetition as an internal strategy, as shown below:

*I learned that when you leave the house, you have to close the door and say three times "I closed the door, I closed the door", you know, "it is closed" (P7).*

*As for going out, I look for it before going out, now lately, taking care of everything, I turn off the gas, you know. Before I used to leave it on, now I turn it off, at night too, I close the gas valve, see if the window is closed (P10).*

In turn, the external compensatory strategies adopted are exemplified in the statements below:

*[...] crossword puzzles, Sudoku, I buy those thick activity books and I really enjoy doing them [...] (P7).*

*I play cards every day online, I play "Buraco", so you have to memorize the cards you take from the table, you know? You have to have a strategy to play, so I think I use it a lot. I have been playing it online for 10 years. I pay a fee to use the site, so I can play any game, but I am used to the hardest games, I only play the hardest, because I do not want a chance for myself, I want to challenge my brain (P8).*

*In the beginning, I also started knitting, crocheting, I started making some sousplats for my daughter for Christmas, she needs 13 for the family, right?! Then I did 5, I think, then I stopped.. you have to be brave, I started making a cap and scarf to donate, then I got tired too and stopped. We get sick of everything when we do not do it willingly, we get tired soon and sick (P1).*

*I write everything down. The shopping list, for example, I make every day, I have it on the computer every day, when I feel something is missing, I write it down on the list. So when my niece comes to do the shopping, the list is practically ready (P2).*

*I read it to my granddaughter, because she does not read it yet, I do dictation for her, I think it helps me too, I try my best not to miss it. I read and subscribe to *Seleções*. It does a lot of good for my head, I learn a lot, because what is on television I do not notice, but when I read in the magazine I do (P8).*

When asked about the influence of cognitive functions on the performance of daily activities, participants declared that there was a correlation mainly with instrumental activities of daily living, as reported below:

*[...] the head is fundamental [...] I think there is no activity that we can do if the head is not good [...] You can't [...] If the head is not good, you don't even get out of bed [...] (P2).*

*I used to let the rice burn a lot, but I took a memory course, and you know, I took that and I never let the rice burn again, I said that I have to pay attention (P8).*

*You're going to make a meal, you have to think about what is in the groceries, what is in the recipe, you are going to turn on the fire, you have to think. I think it influences everything (P2).*

Finally, the participants presented their expectations regarding the impact of cognitive training on their daily activities and brought different perspectives, according to the following statements:

*It contributes a lot, just because of the experience we had there (at the beginning of the project – face-to-face modality), because it activates the brain, right? So it is an activity that puts us to work, to think [...] wow, it helps a lot (P1).*

*Cognitive training gives us more memory, it improves everything, right? I feel much better participating in classes than watching a soap opera. I wouldn't get the result that you give us otherwise, you know? (P8).*

*Oh, I think so, it is good, right? Conversations are missing, these experiences are missing, you no longer have this dialogue with people, no matter how much you can call, talk, it is still not the same thing, right? So I think this little time that we will spend together will be very good (P9).*

*I think it contributes a lot, even to relax, right? To get out of that anxiety, anguish, you know, it is very good, isn't it? Leave certain quirks that we have behind a little, mainly for us to focus on things, to pay attention. And the relationship, which for me is very important, with you, with P1, with everyone... too bad we can't see each other in person. I think I am kind of needy, because I live alone, I don't have relatives, you know, I live in an apartment, so that helps me a lot (P10).*

*Just the fact that we are in a meeting talking is already a breath, you know [...] it is already as if you were here at home talking to me [...] (P2).*

### **Post-training interview and student report**

From the interview carried out at the end of the cognitive training, it was possible to verify, through the participants' reports, the benefits brought about by the intervention. Social participation was a frequently mentioned aspect, taking into account the physical distance resulting from the COVID-19 pandemic, as can be seen in the statements below:

*For me, it was the meeting point with the outside world, I am 100% locked up at home, I live alone, so I saw my escape valve, the conversations. If there was no internet I would be lost (P2).*

*In this pandemic, this course was vital for us, we could not leave the house, it is not easy for us to occupy ourselves, the first minutes, days weeks, months are ok [...] “just read” [...] we cannot stand reading either, because reading is good when you can do zillions of things during the day, then go read a book, but you cannot spend 8/10 days reading (P4).*

*It contributed a lot. Just by knowing that I have an appointment at such a day, at such a time, you know? Even more in our lives right now (P1).*

Regarding the benefits mentioned on cognitive and occupational performance arising from cognitive training, the participants declared improvement in different aspects, as shown below:

*[...] my head is active again, it was like a limbo and now it seems to have been shaken (P2).*

*I have no doubt that the performance of my daily activities has improved (P4).*

*See, the pandemic has been going on for almost nine months, we started to create bad habits, you know, I shifted day and night, all that stuff [...] Now with cognitive training, it gave encouragement, hope and every time the we have hope, oops, tomorrow I will have it again. This is producing hormones and a series of substances inside us and a stimulation without medicine begins, a stimulation inside the individual, intra genito and not outside it, which is endogenous (P4).*

*Since the cognitive training started, I resumed reading, I started remembering things and wanting to remember certain things. Today, by the way, I was talking to my wife, I even told her, wow, how in these last few months I started to remember. And one thing that I started to work more on is very recent memory, that I was discarding recent memory very fast, not today with training I started to think better about this memory (P5).*

*My daily life has changed a lot, right? Because there were a lot of things I didn't pay attention to before, and after classes I started to pay more attention to things, I started to look more broadly (P6).*

*For me it also improved to do the homework, I learned to focus and pay attention to what I'm going to do. The cognitive training made me create good habits (P7).*

*[...] you prepared us to fight the virus, because our immunity with the workshop of course has gone up, and for me the key point of these viruses and any other disease is if immunity is low any flu [can be a] goodbye. Against the coronavirus is the the same thing, the more immunity one has, the more one will know how to face it if one gets infected. If immunity is low, we do not get back home. So this cognitive training helped a lot to increase our immunity, because it wasn't just during the course, it gave*

*fuel for us to continue the day, the next day until we arrive again at the next meeting, so that was vital in this pandemic (P4).*

Finally, the participants pointed out facilitators of the learning process, among which the Internet, didactics and occupational therapy stood out, such as the reports below:

*[...] but I'm glad you guys had the idea to do it online, the format was really good too (P3).*

*[...] you are completely different from the others, I have not found any occupational therapy intervention that did not have a very high level, and the very high level that I say is not only in knowledge, in capacity, it is in interest, it is in dedication, it is in the love you show, it's in the affection, for me attention, affection, dedication is sometimes much more than the individual dominating as if it were God the matter, the content... for me the way the person refers the one that will have the teaching is much more important than the content itself. For the content itself you can pick up a book and learn almost alone, now the way the individual is going through is actually exchanging information, exchanging experiences, as you did to us, this is fundamental (P4).*

*I loved the workshop, I learned a lot. Being individually attended, the occupational therapy student could work better with us, it is great (P7).*

*Occupational therapy helped me in a barbarity, for me it was spectacular (P4).*

Throughout the intervention, the students reported in their field diaries perceptions about the different aspects that covered the cognitive training and the participants, addressing reflective aspects of the learning process in which it was possible to observe different barriers, as demonstrated in the statements below:

*[...] the complaint about the font size was again an agenda at the meeting. The elderly woman does the meetings on her cell phone and this may be one of the reasons for these issues (M4).*

*P7 reported that he was a little sleepy, the day was very hot, and he was a little slow to respond to the first temporal orientation activities [...] (M2).*

*P8 reported that she did not sleep well at night, she was very distracted, and because of this she could not memorize many things, but she tried her best. For the next meetings she reported that she will try to rest better to acquire more knowledge. She did not have good performance in activities, as they were all from the memory function (M2).*

Benefits arising from cognitive training have also been observed, such as mood, memory, concentration and attention:

*In our penultimate meeting, the elderly woman had fun with the activities, I noticed that her mood and performance in the sessions improved as the meetings went on and she engaged in training (M4).*

*In our last individual meeting, the elderly woman commented on how the training was good for her, said that due to the pandemic she felt very lonely and that having a project during the week encouraged her, [she] thanked the student and said she was happy with the meetings (M2).*

*P8 had an excellent performance in the session, every day she is more committed and concentrated. The control of anxiety during activities is noticeable. At the end, she reported that in her daily life she has noticed that she performs activities better, concentrates, pays attention, memorizes. P8 also said that the cognitive training is doing her a lot of good (M2).*

## **Discussion**

Population aging is a global reality, and maturity is associated with several changes, including cognitive changes, resulting from the natural aging process. Given this, society has sought ways to improve the cognitive abilities of the elderly. Among the options, cognitive training has shown good results when applied to healthy elderly people, improving plasticity, cognition, brain reserve capacity and performing daily tasks and activities (Netto, 2017; Raymundo et al., 2017; Maeir et al., 2014).

However, when comparing the amount of evidence accumulated on cognitive training for the elderly in the international literature with the national context, there was a reduced amount of evidence on the effectiveness of programs for the Brazilian population and, naturally, a reduced number of protocols for standardized interventions for our context, especially developed by occupational therapists.

A review of the national literature carried out by Golino & Flores-Mendoza (2016) revealed that of a set of 21 intervention studies on cognitive training, only five publications (23%) provided the intervention development procedures or informed the models used by other authors. In addition, none of the available protocols were developed by occupational therapists considering the impact on the performance of occupations. Based on these findings, this study sought to disseminate an online cognitive training program developed by students and teachers of occupational therapy for healthy elderly people, presenting its steps and procedures and analyzing its impact on the occupational and cognitive performance of these people.

Countless activities and cognitive games were designed and analyzed with a focus on training and stimulation aimed at spatial and temporal orientation, attention, memory, praxis, visual-motor construction and executive functions. The analysis of activities provided, in this study, the identification of demands (personal, social and cultural) and the necessary performance components, thus, enabling ways of adaptation and gradation to promote participation and achieve the proposed objectives (Crepeau & Schell, 2011; Maeir et al., 2014; Levy, 2014).

In addition, participants reported different internal and external compensatory strategies to deal with changes resulting from functional and cognitive decline. According to Levy (2014), internal compensatory strategies are mnemonic techniques of repetition, verbal association, mental imagery and stories, and examples are the organization of information to be remembered and the encoding of information through various sensory modalities (such as the visual and auditory senses). In turn, external compensatory strategies are methods for remembering that depend on objects, places or people, which

provide recognition cues to facilitate the retrieval of desired episodic information. For example, shopping lists, calendars, diaries, time markers, asking other people to remind us, putting everything back in place and leaving objects in strategic places.

Regarding qualitative data, it was found that the effects of cognitive training extended to other variables, leading to a significant improvement in the perception of quality of life and occupational performance of participants in the case group after cognitive training. Studies such as those by Irigaray et al. (2011), Casemiro et al. (2016), Irigaray et al. (2012), Santos et al. (2019), Chariglione & Janczura (2013) and Silva et al. (2021) associate this improvement, in addition to cognitive training, to the engagement and social participation provided by the intervention to the participants.

Furthermore, the intervention study took place in a period of physical distancing caused by the COVID-19 pandemic and, as observed in the results of the interviews, the participants of the case group stated that being involved in an activity was essential and resulted in positive effects. The studies by Chen (2020) and Van Orden et al. (2020) highlight the importance of performing activities during this period, as they can help the elderly in maintaining their physical and mental health and their functional capacity.

However, after comparing the results of this study with those of other studies, it was possible to identify some limitations: results restricted to a small sample, not allowing conclusions about the effectiveness of cognitive training; the lack of studies on occupational therapy at the national level for comparison between studies, since the studies analyzed were from other areas of activity, with peculiarities in their intervention structure; insufficient data to compare the results of interventions during a pandemic period, such as the number of sessions, strategies and cognitive, occupational and social measures to verify their effects.

Among the limitations of the study for the construction of the structure of the cognitive training program and task eligibility, the lack of references for virtual adaptability stands out.

## **Conclusion**

This study achieved its objective: to build an online cognitive training protocol for healthy elderly people, developed by occupational therapists for the Brazilian context. Through it, it was possible to understand the impact of an intervention with the elderly during the COVID-19 pandemic, both on their cognitive functioning and on their social participation.

The intervention took place in a period of restriction of social participation due to the pandemic, with several reports from the participants regarding physical and social isolation. Thus, this intervention emerges as an indispensable tool to promote meaningful activities in the midst of an impoverished daily life. In their reports, the elderly pointed out cognitive, social, psychological and quality of life benefits and the students considered the intervention as a fundamental experience for the construction of their professional identity. In addition, this intervention offers the elderly a way to maintain healthy aging.

The analysis of the activities applied proved to be strategic to systematize the sessions and monitor the performance of the participants. Only with the analysis it was possible to perform the gradation of the exercises and the necessary adaptations to the public served. Thus, it proves to be an indispensable resource for the occupational therapist for the elaboration of a cognitive training, making it feasible to apply this protocol in other audiences, both in healthy and unhealthy elderly people, with the necessary adaptations.

There is also a need to refine the protocol to achieve better results. Future research may overcome the limitations presented in this study with the purpose of facilitating and improving performance in daily activities, in addition to carrying out the application of this protocol with a greater number of elderly people to understand its effects on a large scale.

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### **Author's Contributions**

Gabrieli Pereira da Cruz and Laís Souza Pereira collaborated equally in the structuring of the cognitive training, analysis of activities, data collection, application of sessions and writing of the initial and final versions of the text. Caroline de Faria Pizzetti, Larissa da Silva Kiel and Tássia Felício Canella contributed to the analysis of activities, application of assessments and cognitive training sessions and writing of the final version of the text. Taiuani Marquine Raymundo worked in an equivalent way in the critical revision of the text. All authors approved the final version of the text.

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