International Journal of Social Science Research and Review

http://ijssrr.com
editor@ijssrr.com
Volume 8, Issue 8
August, 2025
Pages: 273-279

Cognitive Training amongst Older Adults - An Intervention

Darves Singh

The British School, New Delhi, India

E-mail: Darves.singh@gmail.com

http://dx.doi.org/10.47814/ijssrr.v8i8.2900

Abstract

Older adults face a gradual decline in cognitive abilities, which can have a severe impact on an individual's standard of living. Sometimes, this cognitive decline eventually leads to dementia. Cognitive training has been used as a method to slow this process. It involves training of specific parts of the brain to keep the participants cognitively healthy. Cognitive decline becomes common after the age of 60. Thus, the present intervention was designed to study the impact of a 6-week cognitive training programme on individuals above 60 years of age. The participants engaged in daily activities which included solving arithmetic problems, quizzes, comprehension, among other things. The participants were tested using the Montreal Cognitive Assessment, and the research followed a pre-post-test design. A paired-sample t-test was conducted, and the results were found to be statistically significant. Thus, well-structured cognitive training can sharpen mental performance in older adults, and highlight the potential of non-pharmacological, easy to access cognitive training in allowing the elderly to remain cognitively flexible and independent.

Keywords: *Cognitive Training; Cognitive Decline; Older Adults; T-Test; Intervention*

Introduction

Cognitive decline refers to a gradual loss in abilities such as: memory, learning, paying attention, and reasoning resulting from changes in the brain's structure which usually accompanies aging [1]. Cognitive decline can result in a condition known as mild cognitive impairment, the in-between stage between typical thinking and dementia. Although it does not affect daily activities, so it may not always impact one's standard of living, it causes memory loss and can induce difficulties with language and judgement [2]. In more extreme cases, however, cognitive decline can lead to dementia, which is a group of diseases and illnesses which impact memory, mood, personality and more to a degree which impacts the standard of living and daily activities of an individual [3]. With around 23.7% of the world's population (more than 2 billion people) suffering from MCI [4], investigating cognitive training and other methods to reduce cognitive decline is of increasing importance, a way to improve standard of living and maintain healthy cognitive function in larger populations. Cognitive decline has been suggested to be more common in individuals above the age of 60-65 years [5], making that the demographic used in this study, people 60 or more years old.

In the case of damage to the brain, it has a protective mechanism known as a cognitive reserve, which is essentially a measure of the brain's ability to reassign certain tasks to different parts of the brain in case it sustains damage, with people with more robust cognitive reserves being less affected by Alzheimer's [6]. This reserve can be built up by stimulating the brain, and is often built up over a lifetime of education, curiosity, and learning [6]. Along with building up one's cognitive reserve, stimulation of the brain could impact cognitive function mediated by neuroplasticity, the ability of the brain to change in response to experience, learning, and damage [7]. This study aimed to stimulate the brain in order to do both aforementioned things using a cognitive training (CT) regimen, which participants would do for 6 weeks.

Cognitive training (CT) refers to the training of specific aspects of the brain's function including memory and other thinking skills [8]. It can consist of a variety of tasks, ranging from computerised games and exercises which are specifically designed in order to activate and utilise multiple cognitive functions together, or teaching in order to facilitate certain areas of function that are particularly weaker than others [9]. This investigation uses a cognitive intervention program adapted from Kawashima et al, 2008 [10], which used arithmetic and language tasks as their intervention, giving participants a few language and mathematics tasks everyday with increasing difficulty, while still ensuring the tasks could be completed within 15 minutes.

Kawashima and colleagues (2008), conducted a cognitive intervention study which was carried out in Japan, investigating the impact of practicing arithmetic and language every day for 6 months on cognitive function in a sample of elderly Japanese citizens, 3106 of them. In this study they found a statistically significant increase in the FAB (frontal assessment barrier) and DST (developmental screening test). Although the change wasn't visible in the MMSE (mini mental state examination), the increase in the other two forms of neuropsychological testing provides evidence for the impact of cognitive training on function [10]. Furthermore, in a systematic review carried out by Bhome and colleagues (2018), on interventions for cognitive decline, they concluded that cognitive training programmed led to "small, statistically significant improvement in objective cognitive performance" further reinforcing the researched impact of CT regimens on cognitive function [11].

As stated earlier, the cognitive training regimen programme designed for this investigation was created for 6 weeks and made up of arithmetic, reading comprehension, short paragraph writing, and an additional task for each day. These additional tasks could range anywhere from "odd one out" tasks (in order to target cognitive functions like reasoning, or problems solving), to word searches (to target language processing or and memory), to "spot the difference" tasks (targeting attention to detail and observational skills.) This variation in tasks was chosen in order to activate a large portion of the brain, creating a holistic training regimen to improve overall cognitive function as tested by the MoCA (Montreal cognitive assessment). Hence, this investigation into the impact of CT on cognitive function will investigate the following research question - What impact does cognitive training have on cognitive decline in adults aged 60 and above (measured by the MoCA).

Method

Research Objective

To evaluate the effectiveness of simple cognitive exercises in slowing the progression of cognitive decline among older adults in the Indian context. Centering on this objective, the following hypotheses were constructed:

Null Hypothesis (H_0): There will be no statistically significant difference between the test scores obtained before and after the 6-week cognitive training programme. Any observed correlation or change in scores will be attributable to chance.

Alternative Hypothesis (H_1): Participants who undergo the 6-week cognitive training programme will demonstrate a statistically significant improvement in their test scores compared to their baseline performance.

Materials

Cognitive tests are short, quick tests to check how well the brain is functioning. The tests are not used to diagnose specific illnesses, but rather to identify a problem with cognition and the potential need for further testing [12]. One such test, which is used in this investigation, is the Montreal Cognitive Assessment (MoCA), which is a useful cognitive screening tool with tested and proven sound validity and reliability [13]. It tests visuospatial skills, attention, language, abstract reasoning, delayed recall, executive function, and orientation, making it a holistic test of cognitive function.

Participants

The participants were recruited using purposive sampling which refers to a process where researchers choose participants based on specific characteristics or unique experiences related to the research question [14]. This was used as the participants conform to a very specific demographic. Thus the inclusion criteria for the present study was - individuals aged above 60 years age, with a minimum of formal high school education. Moreover the participants should be fluent in English, and should be currently residing in the Delhi-NCR region, India. The specific demographic details of the participants are presented in Table 1.

Table 1 Demographic Details

Demographic Criteria	Category	Frequency
Gender	Male	10
	Female	11
Age	60-70	6
	70-80	6
	80+	9

Procedure

Participants were first met by a researcher, where they were provided with a consent form to read and sign, along with a sheet of paper on which they filled out details regarding their name, sex, age, marital status, level of education, and occupation. They were also told about the research project and its objective, asking questions as they thought of them. Then, the 'pre' Montreal Cognitive Assessment (MoCA) was conducted on each participant and scored by the same researcher in order to eliminate bias. After the test was conducted, participants were provided with a printed and bound copy of the Task Sheets, designed for exactly 6 weeks, and were asked to complete the tasks assigned for each day for the next 42 days. After the 6 weeks were complete, they were once again visited by a researcher, where they were made to take another 'post' MoCA and were once again scored by the same researcher.

Statistical Analysis

The effectiveness of the cognitive training intervention was evaluated by employing a paired sample t-test to compare participants scores before and after the cognitive training. This statistical test is appropriate when measuring the mean difference between two related groups, which in this case, were the participants' pre and post test scores. The test also controls for individual variability, allowing a more accurate assessment of the intervention's effect.

Ethical Considerations

Informed consent was obtained from all participants before they participated in the study, being made aware of the procedure and structure of the testing and booklet, and what their responsibilities would be. Additionally, they were ensured that they would be able to withdraw from the study at any point if they felt the need. Finally, strict anonymity was maintained throughout the study, including scores and personal information, and the booklet was designed to reduce any undue harm or stress, keeping the workload for a day light and the booklet fairly simple yet cognitively stimulating.

Results

A paired sample t-test was conducted to examine the effect of the cognitive training intervention on the participants' test (MoCA) scores. There was a statistically significant increase in scores from the pre-test to the post-test, **$t(20) = -6.11$, $p < .001$**, with a mean difference of **-3.24** (SD = 2.43). The 95% confidence interval for the mean difference ranged from **-4.34 to -2.13**, indicating that post-test scores were significantly higher than pre-test scores. These results suggest that the intervention had a **significant positive effect** on performance of the participants on the MoCA.The results are depicted in Table 2 and 3.

Table 2 - Mean and Standard Deviation

	Mean	Standard Deviation	Standard Error of Mean
Pre-test	21.67	3.440	.751
Post-test	24.90	3.208	.700

Table 3 - t-test results

Mean Difference	Standard Deviation	Standard Error Mean	95% Confidence Interval of the Difference		t	p
-3.238	2.427	0.530	-4.343 (lower)	-2.133 (upper)	-6.114	<.001

Discussion

As presented in the results section, this cognitive training intervention resulted in a statistically significant improvement of overall cognitive function, as measured using the Montreal Cognitive Assessment. The mean increase in the score seen in the participants was 3.24 points (out of the 30 that it is scored out of), along with a 95% confidence interval that participants who undergo the intervention will increase by 2.13 to 4.34 points, emphasising the reliability of the results. Most importantly, the results were extremely statistically significant, with the probability of them occurring by change being placed at less than 0.001. Hence, the improvements strongly represent the robust effect of the cognitive training intervention.

The improvement in the MoCA scores reflects the impact of the neurocognitive mechanisms being activated during the intervention on overall brain function as it tests multiple domains including attention, executive function, memory, and visuospatial processing. One possible explanation for this improvement in scores lies in the concept of neuroplasticity. As discussed earlier, even as brains age, they retain a certain degree of neuroplasticity [7]. This means that through repeated stimulation of certain regions of the brain, new neural networks can be formed. Tasks that challenge working memory, attention, and reasoning would all promote activity in the prefrontal cortex and hippocampus, regions associated with learning and memory [15]. Hence, by engaging the areas frequently during the intervention, participants may have strengthened cognitive processing by gaining more neural networks in their brain, specifically the aforementioned parts. Another factor may be the cognitive reserve, the aforementioned store of information that allows humans to reassign parts of the brain to avoid damage having serious impacts on cognitive function [6]. Participants may have grown their cognitive reserves through repeated stimulation in the cognitive training intervention (as they did in neuroplasticity), improving their performance in the MoCA. The statistically significant improvement suggests that the observed improvement was not solely due to chance or due to practice alone, especially since the confidence interval didn't include 0. Overall, the results display that cognitive interventions, even ones occurring or as short as 6-weeks can have positive cognitive effects on the elderly.

Although the calculated statistical significance does attribute the increases in cognitive ability to the training, there were certain drawbacks and limitations which naturally occurred, whether they were systematic or random errors. To begin, there were systematic limitations to the experiment, such as the small sample size, which, after much struggle, was limited to 21 participants, all of whom had a minimum of a high school education, and most of which were college educated. All participants were above 60, proficient in English, and residing in New Delhi or Gurgaon, limiting the generalisability of the results to the wider geriatric Indian population. Additionally, there were random errors too, which could not be controlled for. These included daily variability in the effort that participants would put into their cognitive training booklet everyday, and whether participants were receiving external cognitive stimulation, outside the intervention, like reading books, or completing crosswords and sudoku's in the daily newspaper, all of which would impact their cognitive function, but would likely be negligible as these activities would already be strongly rooted into their daily routines, and the sole *new* addition that would be cognitively stimulating would be the booklet. As for the MoCA itself, there were few issues. However, some included a ceiling effect, in which high scoring performers (scoring 26 or 27 out of 30 in their pre-test) would have little area for improvement in the post-test, making cognitive function gains less hard to detect. Additionally, there was a test-retest bias, in which participants may have been more comfortable taking the test the second time, which could have contributed to slight increases in score. Regardless, it's important to remember that a statistical significance of less than 0.001 strongly suggests that the improvements resulted from the cognitive training regimen itself.

The present results also align with previously published cognitive training interventions, such as Kawashima and colleagues (2008) who, as mentioned above, reported an increase in FAB and DST scores after participants had undergone a cognitive training intervention, although their MMSE scores did not increase [10]. They also align with Ball and colleagues (2002), who observed reliable cognitive improvement directly after their intervention period, similar to the improvement observed in the present scenario [16]. More recent analysis likewise report significant gains in global cognition and specific domains (attention, executive function, working memory), while emphasizing heterogeneity and the importance of program design and adherence [17].

The clear rise in MoCA scores after the intervention confirms that well-structured cognitive training can sharpen mental performance in older adults. With the global aging trend and the concurrent rise in dementia cases, these results are particularly relevant to public health. The recorded improvements indicate that inexpensive, drug-free strategies might slow cognitive decline and help older adults sustain mental agility. Spreading such programs through community centers, residential care facilities, and user-friendly apps could ensure cognitive engagement reaches a broad, scalable audience.

Still, the short-lived gains that were observed raise questions about their staying power. Future studies must track whether the benefits endure after training ends and whether they affect everyday tasks and overall well-being. To enhance the findings' applicability, larger, multi-site randomized controlled trials featuring varied demographic groups are needed. Merging cognitive assessments with neuroimaging, like fMRI or EEG, could illuminate the brain-level changes that underpin the present results. Identifying which specific training components deliver the strongest results would further refine and strengthen program design and implementation.

Conclusion

In conclusion, the results of this study demonstrate that the cognitive training intervention significantly improved the MoCA scores of the participants. Additionally, the paired sample t-test confirmed that the results were statistically significant, reinforcing the effectiveness of structured mental exercises on improving cognitive function. The findings highlight the potential of non-pharmacological, easy to access cognitive training in allowing the elderly to remain cognitively flexible and independent. While the results are promising, future research with larger sample sizes, longer follow up periods, and varied cognitive measures and training regimens are suggested to further validate the findings. All in all, the study provides compelling evidence for the value of cognitive training as a tool in aging care.

References

[1] Mfa, R. J. S. (2024, November 4). *Understanding Cognitive Decline: How your brain changes as you age*. Healthline. https://www.healthline.com/health/cognitive-decline.

[2] *Mild cognitive impairment - Symptoms and causes*. (n.d.). Mayo Clinic. https://www.mayoclinic.org/diseases-conditions/mild-cognitive-impairment/symptoms-causes/syc-20354578.

[3] *Dementia*. (n.d.). Cleveland Clinic. https://my.clevelandclinic.org/health/diseases/9170-dementia.

[4] O'Connor, J. (2025, May 6). *Report: 23.7% of people globally have mild cognitive impairment - McKnight's Long-Term Care News*. McKnight's Long-Term Care News. https://www.mcknights.com/news/report-23-7-of-people-globally-have-mild-cognitive-impairment/.

[5] Plassman, B. L., Welsh, K. A., Helms, M., Brandt, J., Page, W. F., & Breitner, J. C. (1995). Intelligence and education as predictors of cognitive state in late life: a 50-year follow-up. *Neurology*, *45*(8), 1446–1450. https://doi.org/10.1212/wnl.45.8.1446.

[6] Harvard Health. (2024, February 1). *What is cognitive reserve?* https://www.health.harvard.edu/mind-and-mood/what-is-cognitive-reserve.

[7] D'Antonio, J., Simon-Pearson, L., Goldberg, T., Sneed, J. R., Rushia, S., Kerner, N., Andrews, H., Hellegers, C., Tolbert, S., Perea, E., Petrella, J., Doraiswamy, P. M., & Devanand, D. (2019). Cognitive training and neuroplasticity in mild cognitive impairment (COG-IT): protocol for a two-site, blinded, randomised, controlled treatment trial. *BMJ open*, *9*(8), e028536. https://doi.org/10.1136/bmjopen-2018-028536.

[8] *Cognitive training | BPS - British Psychological Society*. (n.d.). https://explore.bps.org.uk/content/repguideline/bpsrep.2014.rep101c/chapter/bpsrep.2014.rep101c.11.

[9] Mowszowski, L., Batchelor, J., & Naismith, S. L. (2010). Early intervention for cognitive decline: can cognitive training be used as a selective prevention technique?. *International psychogeriatrics*, *22*(4), 537–548. https://doi.org/10.1017/S1041610209991748.

[10] Uchida, S., & Kawashima, R. (2008). Reading and solving arithmetic problems improves cognitive functions of normal aged people: a randomized controlled study. *Age (Dordrecht, Netherlands)*, *30*(1), 21–29. https://doi.org/10.1007/s11357-007-9044-x.

[11] Bhome, R., Berry, A. J., Huntley, J. D., & Howard, R. J. (2018). Interventions for subjective cognitive decline: systematic review and meta-analysis. *BMJ Open*, *8*(7), e021610. https://doi.org/10.1136/bmjopen-2018-021610.

[12] Professional, C. C. M. (2025, June 30). *Cognitive test*. Cleveland Clinic. https://my.clevelandclinic.org/health/articles/22306-cognitive-test .

[13] Lord, A. R., Amitrano, N. R., & González, D. A. (2024). Reliability and validity of the Montreal Cognitive Assessment's auditory items (MoCA-22). *The Clinical neuropsychologist*, *38*(3), 783–798. https://doi.org/10.1080/13854046.2023.2261634.

[14] Sooleen Abbas. (2024, May 20). *Different types of sampling techniques in qualitative research*. Sago. https://sago.com/en/resources/blog/different-types-of-sampling-techniques-in-qualitative-research/#anchor2.

[15] Funahashi S. (2017). Working Memory in the Prefrontal Cortex. *Brain sciences*, *7*(5), 49. https://doi.org/10.3390/brainsci7050049.

[16] Ball, K., Berch, D. B., Helmers, K. F., Jobe, J. B., Leveck, M. D., Marsiske, M., Morris, J. N., Rebok, G. W., Smith, D. M., Tennstedt, S. L., Unverzagt, F. W., Willis, S. L., & Advanced Cognitive Training for Independent and Vital Elderly Study Group (2002). Effects of cognitive training interventions with older adults: a randomized controlled trial. *JAMA*, *288*(18), 2271–2281. https://doi.org/10.1001/jama.288.18.2271.

[17] Yun, S., & Ryu, S. (2022). The effects of cognitive-based interventions in older adults: a systematic review and Meta-analysis. *Iranian Journal of Public Health*, *51*(1), 1. 10.18502/ijph.v51i1.8286.