A Tablet for Healthy Ageing: The Effect of a Tablet Computer Training Intervention on Cognitive Abilities in Older Adults

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Objective: *To test the efficacy of a tablet computer training intervention to improve cognitive abilities of older adults.* **Design:** *Prospective randomized controlled trial.* **Setting:** *Community-based aging intervention study, Edinburgh, UK.* **Participants:** *Forty-eight healthy older adults aged 65 to 76 years were recruited at baseline with no or minimal tablet experience; 43 completed follow-up testing.* **Intervention:** *Twenty-two participants attended a weekly 2-hour class for 10 weeks during which they learned how to use a tablet and various applications on it.* **Measurements:** *A battery of cognitive tests from the WAIS-IV measuring the domains of Verbal Comprehension, Perceptual Processing, Working Memory, and Processing Speed, as well as health, psychological, and well-being measures.* **Results:** *A 2 × 2 mixed model ANOVA suggested that the tablet intervention group (N = 22) showed greater improvements in Processing Speed ($\eta^2 = 0.10$) compared with controls (N = 21), but did not differ in Verbal Comprehension, Perceptual Processing, or Working Memory (η^2 ranged from −0.03 to 0.04).* **Conclusions:** *Engagement in a new mentally challenging activity (tablet training) was associated with improved processing speed. Acquiring skills in later life, including those related to adopting new technologies, may therefore have the potential to reduce or delay cognitive changes associated with ageing. It is important to understand how the development of these skills might further facilitate everyday activities, and also improve older adults' quality of life.* (Am J Geriatr Psychiatry 2017; 25:841–851)

Key Words: Cognitive aging, intervention, older adults, tablet computers, technology

For the first time in history, the number of people aged 65 years or older is soon expected to outnumber children under age 5 years.[1] It is important to understand age-related changes in cognitive abilities for both individual and societal reasons. Cognitive decline can compromise the quality of life of older adults and limit their independence.[2] Therefore, effective interventions that might reduce or delay

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cognitive decline, or indeed lead to improvements in cognitive ability, are critical for the older population, especially those at higher risk of cognitive decline.[3]

Engaging in cognitively demanding tasks has been associated with the maintenance of cognitive abilities—as the popular saying "use it or lose it" implies. The use-it-or-lose it theory also proposes that increases in cognitive activity have the potential to reduce cognitive decline associated with healthy as well as pathological aging.[4,5] To date, there has been a strong focus on cognitive training rather than cognitive engagement. Cognitive training, where an individual is engaged in a focused, repetitive task is usually targeted at improving a specific cognitive ability, though improvements across a range of cognitive abilities, or transfer, would be a key goal. In contrast, participating in activities that involve novel learning experiences and acquiring new skills may simultaneously train a number of cognitive abilities including executive function, reasoning, and memory.[6] Cognitive engagement versus more focused cognitive training may therefore offer opportunities to produce broader benefits.

Support for the benefits of cognitive engagement has come from observational studies that generally report higher participation in cognitively stimulating activities to be associated with better cognitive ability and healthier brain parameters, such as greater gray matter volume[7] and reduced rates of hippocampal atrophy.[8] It is rarely possible, however, to definitively state whether this evidence supports preserved differentiation or differential preservation: Does the cognitive engagement preserve or improve cognitive ability, or is it simply the case that people with higher cognitive ability are more likely to engage with cognitively stimulating activities?[9,10]

The causal pathway is often more clearly articulated in experimental studies, and these have also found cognitive engagement to be beneficial for cognitive function in aging. For example, compared with a control group, participants aged 60–75 years engaged in novel problem solving and creative activities (e.g., creative drawing, logic puzzles, musical activity) for 10–12 weeks showed significant improvement on measures of fluid intelligence.[11] Similarly, in the Senior Odyssey study,[12] participants aged 59–93 years were engaged in group problem-solving competitions that involved various cognitive processes including reasoning and working memory for 20 weeks. At the end of the program, experimental participants showed improved fluid cognitive ability. In the Experience Corps, adults over 60 years (mean: 70.1, SD: 6.4 years) taught classroom behavior, reading skills, and library support to children from kindergarten to third grade.[13] Improvements in executive function and memory were reported at 4, 6, and 8 months. These studies are consistent with the suggestion that increased engagement in cognitively demanding activities might preserve or improve cognitive abilities in older adults.

In the Synapse Project, Park and colleagues[14] randomized older adults (aged 60–90 years) to three engagement groups: learning either quilting, or digital photography, or a combination of both quilting and digital photography. The activities were referred to as "productive engagement" as the tasks were new and cognitively demanding. Two "receptive engagement" groups were also included for comparison, involving familiar activities low on cognitive demand: one social group that engaged in social interactions, trips, and entertainment, and one placebo group that engaged in tasks that were less likely to have cognitive benefits (e.g., listening to music). Participants in the productive engagement groups spent an average of 15 hours per week in the Synapse environment: this time included both formal instruction (5 hours) and completion of course assignments (10 hours). Similarly, individuals in the social group participated for an average of 15 hours per week, comprising common structured activities (5 hours) and additional activities with other members (10 hours). The placebo group made the same time commitment but performed a structured set of activities that required existing knowledge (e.g., watching documentaries, word knowledge games) rather than tasks that represented novel engagement experiences. After the 3-month intervention period, the productive engagement groups (quilting and/or photography) showed significant improvement in episodic memory compared with the receptive engagement groups. Park et al. therefore concluded that learning new skills can improve cognitive ability.

More recently, in an extension of the Synapse Project, Chan and colleagues[15] trained 18 older adults (aged 60–90 years) who were computer novices to use a tablet computer (iPad). Participants attended a tablet training course once a week for 3 months. Cognitive performance was compared with a placebo group that engaged in passive tasks requiring limited new learning, and a social group that had regular social interaction, but no active skill acquisition. As an