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Brain training: is it integral to cognitive health?

By Paul Nussbaum

Neural plasticity is not a new concept, but it has in recent years re-emerged in the neuroscience field as an exciting consideration for the human brain and behavior. Because of the human brain's plasticity, research indicates it can generate new brain cells, which is called "neurogenesis," according to a 1998 article by Eriksson et al. in *Nature Medicine* (goo.gl/yO9xDX).

We also have the ability to build "brain resilience," writes Wilson in a 2011 article in *Generations* (goo.gl/NyDnjr). This can occur over the human life span, and some have argued that this resilience offers resistance to neurodegenerative diseases such as dementia, however, there is still no prevention and certainly no cure for such conditions.

The idea of plasticity has led to basic yet revolutionary opportunities. Research has shown that a healthy lifestyle (good nutrition, physical activity, mental stimulation, socialization and spirituality-stress reduction) promotes health and reduces the risk of dementia and mood disorders (see *Magic Trees of the Mind* by Marion Diamond and Janet Hopson [New York: Plume, 1998]; and my book, *Brain Health and Wellness*, [Tarentum, PA: Word Association Publishers, 2003]).

It makes reasonable sense, then, that we should engage in brain training exercises to stimulate and shape the brain. The larger and more scrutinized issue is whether such brain training has any clinical value.

A Brief Overview of Brain Training

There are multiple companies in the brain-training industry, defined as digital gaming that engages the consumer in a series of exercises that are primarily, though not exclusively, cognitively focused. Games are built around stimuli that involve memory, language, visual-spatial, executive, reaction time, attention and processing speed (accuracy and time it takes to distinguish two or more emerging stimuli set among distracting stimuli).

As brain training became popular, experts began to ask if it held any clinical benefit. This concern generated increased attention when in October 2014 more than 70 academics published a consensus statement, asserting that playing brain games had been shown to improve little more than the ability to play brain games. The impetus behind this statement was that brain training was being touted as preventing or even reversing Alzheimer's disease, with no supporting science.

Plenty of research has demonstrated the health-promoting effects of certain behaviors upon cognitive, emotional and motor skills. But it is important to distinguish such health promotion from disease prevention. In my opinion, brain fitness and training are factors that promote brain health by keeping people engaged and active socially, but their clinical value remains uncertain.

Emerging Research Findings

Ongoing randomized and controlled trials investigating the clinical efficacy of brain training have been published. A fair number, though not all, originate from the Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) study that began in 1998 and has produced more than 50 peer-reviewed studies. The ACTIVE study included nearly 3,000 healthy participants older than age 65 who live in community.

Early findings indicated there was some lasting benefit of up to five years to brain training for older healthy persons. A 2014 study by Rebok et al., published in the *Journal of the American Geriatrics Society* (goo.gl/Op0M5c), found that ongoing brain training for older persons (average age, 74) for 10 sessions of an hour or more over five to six weeks demonstrated a benefit in improved cognitive abilities for 10 years, relative to a control group. Participants benefitted most from brain training in reasoning and speed of processing relative to controls. Memory training outcomes were not as robust.

A second study reported that a sample of persons older than age 65 who lived independently, had no clinical depression and who engaged in ongoing brain training (specifically, in a brain game involving speed of processing) reduced their risk of depression by 38 percent, relative to controls at one-year follow-up, according to Wolinsky et al. in a 2009 article published in the *Journal of Gerontology: Psychological Sciences* (goo.gl/hQBnSp).

A third and more recent longitudinal-controlled study with healthy participants (average age, 73.6) without dementia and living in the community within the ACTIVE study indicates that brain training can cut dementia risk by 48 percent, according to a paper presented by Edwards et al. at the 2016 annual meeting of the Alzheimer's Association in Toronto. As this was a multi-site, randomized controlled trial, the results have generated significant interest to dementia caregivers and all involved in the study. The study randomized participants into one of four groups, including a control group, which received no brain training. The other groups participated in reasoning, memory or speed of processing brain training for 10 sessions over five weeks. Once again, the speed-of-processing exercises seemed to be most beneficial to reduction in risk of dementia over time.

Brain Training: A Personal Perspective

Brain training has inherent appeal. What follows are my opinions on the current viability of brain training for the general public and the clinical-scientific community.

Neural plasticity is a powerful reality of the human brain that requires continued in-depth research and consumer/clinical application, as our ability to shape the brain for health across the life span is significant.

Robust research continues to be published on the health-promoting and, in some cases, clinically relevant findings of lifestyle on brain function and even brain structure, including research on the benefit of regular physical activity on the volumetric measures of the hippocampus and memory function; the effects of meditation and mindfulness on structures of attention and our ability to reduce stress and increase focus; remaining engaged in socially enriched interaction; a reduction in loneliness and cognitive decline; and the role of ongoing mental stimulation for brain resilience.

Brain training provides a reasonable, digitally based input to the brain that engages the consumer in focus, attention, fun, competition, stress reduction, socialization and cognitive stimulation.

The brain training industry understands the need to remain cautious regarding conclusive statements on the clinical efficacy of engaging in ongoing brain training, and no claims should be made that such activity prevents or cures neurodegenerative disease.

Research has been ongoing within the brain training industry to include randomized, controlled and multi-site longitudinal investigations that have provided increasing support for a role of brain training within the clinical arena, including investigation of the role of brain training for clinical

conditions of mild cognitive impairment and mood disorder. Early indications show a potentially useful role for such training as a clinical intervention, but more research is needed to confirm this.

Early indications from such research suggest brain training may have value with not only cognitive health, but also emotional health. This is likely due to the fact that our neural systems that control some underlying cognitive functions also are influenced by similar systems that control underlying emotional function. As such, it may be that specific brain training exercises are affecting both systems or that positive influence on one of these systems has a potentially beneficial effect on the other.

Ongoing controlled and randomized studies are needed to replicate the findings of the studies published and presented to date. As with all ongoing areas of new inquiry, further randomized and controlled studies are necessary to help develop a consistency of findings and a reasonable confirmation on the efficacy of a given intervention.

Speed of processing appears to be one cognitive function that, when stimulated over time through brain training, has potential clinical value for both cognitive and emotional health. The neural subsystems underlying processing speed merit further research to explore a possible integrated role in cognitive and emotional functioning.

Brain training can be considered one part of a comprehensive proactive brain health lifestyle. Its value will only increase with replication of findings noted above. It is probable that prevention or cure of any neurodegenerative condition will need to be multi-factorial, given the complexity of the human brain.

Crafting a Cogent Discussion

My hope in writing this opinion piece is to help craft the discussion around brain training. Our brains are shaped across our life span, and brain training can certainly be included as one of many types of stimulation that can shape the brain.

Brain training is already a useful activity for promoting health, as it can keep an individual engaged, cognitively challenged, socially active and imbue a sense of purpose. Brain training as a clinical intervention is less established, and we should be cautious about any claims otherwise.

Reputable scientists have been working on research that demonstrates a maturation of brain training, with new evidence that points to brain training as a potentially useful clinical intervention. At this juncture, no conclusions can be made about this idea. However, the few studies cited above indicate brain training has a positive effect on cognitive functioning in healthy older persons over time, demonstrates some ability to minimize the risk of depression in otherwise healthy older persons and has some value in reducing risk of dementia in healthy older persons.

This is encouraging and the findings deserve critical attention and additional funding for ongoing research to replicate promising results. We should all remain cautiously optimistic that brain training is another intervention that can help older persons maintain cognitive and emotional health. ■

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Editor's note: Dr. Nussbaum is a co-founder of FitBrains and now works with Rosetta Stone FitBrains.