Published in final edited form as:

J Neurosci Nurs. 2015 June ; 47(3): 178–188. doi:10.1097/JNN.0000000000000133.

Memory Training Plus Yoga for Older Adults

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Abstract

Previous tests of the SeniorWISE intervention with community-residing older adults that were designed to improve affect and cognitive performance were successful and positively affected these outcomes. In this study, we tested whether adding yoga to the intervention would affect the outcomes. Using a quasiexperimental pre–post design, we delivered 12 hours of SeniorWISE memory training that included a 30-minute yoga component before each training session. The intervention was based on the four components of self-efficacy theory: enactive mastery experience, vicarious experience, verbal persuasion, and physiologic arousal. We recruited 133 older adults between the ages of 53 and 96 years from four retirement communities in Central Texas. Individuals were screened and tested and then attended training sessions two times a week over 4 weeks. A septuagenarian licensed psychologist taught the memory training, and a certified yoga instructor taught yoga. Eighty-three participants completed at least 9 hours (75%) of the training and completed the posttest. Those individuals who completed made significant gains in memory performance, instrumental activities of daily living, and memory self-efficacy and had fewer depressive symptoms. Thirteen individuals advanced from poor to normal memory performance, and seven improved from impaired to poor memory performance; thus, 20 individuals improved enough to advance to a higher functioning memory group. The findings from this study of a memory training intervention plus yoga training show that the benefits of multifactorial interventions had additive benefits. The combined treatments offer a unique model for brain health programs and the promotion of nonpharmacological treatment with the goals of maintaining healthy brain function and boosting brain plasticity.

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The authors declare no conflicts of interest

Keywords

cognitive performance; elderly; memory training; octogenarians; yoga training

Data from the 2010 Census indicate that the fastest-growing segment of the total population is the oldest old—those 80 years old and over (<http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf>; U.S. Census Bureau, 2010). This group will triple from 5.7 million in 2010 to over 19 million by 2050. As the population ages, the prevalence of mild cognitive impairment or preclinical dementia is increasing, although not in a linear fashion. Epidemiological evidence indicates that 22%–31% of Americans aged 71 years or older have some type of cognitive impairment (Lopez et al., 2012; McDougall, Becker, & Arheart, 2006; Plassman et al., 2008). Complaints about a failing memory are an everyday concern for many older adults, or metamemory, that is, individuals' knowledge, perceptions, and beliefs about their own memory.

The Decade of the Brain, a 10-year federal effort to enhance public awareness of the benefits to be derived from brain research, led to the discovery that the brain is adaptable throughout life and able to produce new cells—known as neurogenesis in adulthood (Jones & Mendell, 1999). These discoveries pointed to the importance of maintaining healthy brain function and boosting brain plasticity. Because most (92% up to 2010) of the published research is from rodent data and not human data, the extrapolation of these findings to humans and research on adult human neurogenesis is in the early phases of discovery (Bergmann & Frisen, 2013; Sierra, Encinas, & Maletic-Savatic, 2011). Nevertheless, applied studies of various memory and cognitive interventions are ongoing with humans with the goal of improving neural plasticity and cognitive reserve (Miller et al., 2012).

After nearly 40 years of memory training research with older adults, a number of principles have been learned (Verhaegen, Marcoen, & Goosens, 1992). Cognitive training may generate neurons and synapses, and there is evidence from research that humans adapt to the challenges of their environments (Bergmann & Frisen, 2013). Second, training builds psychological confidence for everyday activities that promote living independently such as medication adherence and remembering doctor's appointments. Third, training promotes mental discipline, enhances intellectual sharpness, and develops cognitive vigor (McDougall, 2009). In summary, research shows that individual differences in behavior are reflected in individual differences in brain plasticity (Freund et al., 2013).

The ACTIVE trials showed that older adults benefited from the training and the effects were durable across many years (Gross & Rebok, 2011; Rebok et al., 2013). However, the training effects were not generalizable to everyday tasks (ACTIVE), and the training did not delay or slow progression to Alzheimer disease. Thus, although the evidence for memory training is positive, firm conclusions cannot be drawn about the association of any modifiable risk factor with cognitive decline or Alzheimer disease. Furthermore, there is insufficient evidence to support the use of pharmaceutical agents or dietary supplements to prevent cognitive decline (Daviglus et al., 2010).

The social engagement hypothesis has been supported by group experiences of older adults in a traditional classroom-based learning environment (McDougall, 2002; McDougall, Becker, Vaughan, Acee, & Delville, 2010; Stine-Morrow, Parisi, Morrow, Greene, & Park, 2007). The “use it or lose it” hypothesis and disuse hypothesis seem to resonate with this cohort of older adults, who are comfortable with the mental discipline model of learning (Bielak, 2010).

Memory training programs often target improving episodic memory by teaching memory strategies to compensate for loss of memory with aging (Verhaeghen, VanRanst, & Marcoen, 1993). However, older adults encounter difficulty in transferring this new learned content into their daily lives (Bherer et al., 2008; Carretti, Borella, Zavagnin, & De Beni, 2011; Li et al., 2008). A recent meta-analysis of memory training studies confirmed that training in the use of multiple strategies was associated with larger training gains although no strategy was preferred; neither did the age of the participant, the length of the session, and the type of control condition (Gross et al., 2012).

Self-efficacy is a useful theoretical underpinning for memory training (Bandura, 1989, 1991; Hastings & West, 2009; McDougall, 2009; West, 2011; West, Bagwell, & Dark-Freudeman, 2008). The four components of self-efficacy theory include enactive mastery, vicarious experience, verbal persuasion, and physiological arousal. These four mechanisms that work in tandem to build a domain-specific type of self-efficacy, such as memory confidence, can be operationalized into specific phases to guide the memory training curriculum. First, enactive mastery experience with exposure and repeated practice is operationalized using the metacognitive strategies of verbal elaboration and controlled handling. Next, vicarious experience is operationalized with relevant and self-modeling and cognitive self-modeling using awareness, mental exercise, and exposure. Third, verbal persuasion is operationalized with exercise, exposure using think-aloud strategies, and motivation. Finally, physiologic arousal is operationalized with desensitization using imagery, breathing, and visualization.

These researchers examine memory training programs that support “use it or lose it” and disuse hypotheses in a cohort of older adults with memory complaints. Study participants received structured classroom training as well as training in yoga techniques.

Memory self-efficacy is a self-evaluative system of belief in one’s capacity to use memory effectively in a domain of function and has been associated with memory performance and use of memory strategies (Bandura, 1989; 1991; Rebok, Carlson, & Langbaum, 2007). Negatively influenced by anxiety and unchallenging environments, memory self-efficacy decreases with age, and negative beliefs may impair memory performance (Seeman, Rodin, & Albert, 1993). Memory self-efficacy, or confidence in everyday memory, decreases with age (McDougall, 2009).

Nontraditional approaches for memory training may also increase gains (Park, Gutches, Meade, & Stine-Morrow, 2007; Rebok et al., 2007). A 2008 meta-analysis of 11 randomized clinical trials determined that aerobic fitness interventions improved cognitive function among nonimpaired older adults with effects observed for motor function, cognitive speed, and auditory and visual attention (Angevaeren, Aufdemkampe, Verhaar, Aleman, & Vanhees,

2008). In a recent meta-analysis of 42 studies, aerobic exercise interventions with healthy older adults improved performance on untrained cognitive tasks (Hindin & Zelinski, 2012).

In longitudinal studies of older adults, anxiety and cognition had a curvilinear relationship, whereas depressive symptoms were always negatively associated with cognitive performance (Bierman, Comijs, Jonker, & Beekman, 2005). Yesavage (1985) was the first researcher to include relaxation training in memory intervention programs and showed significant benefits from reducing anxiety. Complimentary therapies such as yoga are a popular mind-body exercise phenomenon, for anxiety and stress, general well-being, health conditions, chronic illness, and particularly, improvement of balance in older adults; however, there are no published studies of memory training integrated with yoga training (Li & Goldsmith, 2011; Oken et al., 2006; Rocha et al., 2012).

In this study, we therefore tested whether older adults who received a multifactorial intervention that included the SeniorWISE-based memory training and yoga would show significantly better memory self-efficacy and memory performance, significantly fewer memory complaints, significantly less anxiety and depression, and significantly better function in instrumental activities of daily living from baseline to immediate postintervention.

Methods

Setting and Sample

We recruited adults over 50 years old with memory complaints who were living in four retirement communities in Central Texas selected to represent varying demographics and socioeconomic status. We recruited individuals living in retirement facilities and anyone over 50 years old who could enroll. The four sites were the Rebekah Baines Johnson (RBJ) Retirement Community (n = 23), Lyons Gardens (n = 13), Westminster Manor (n = 24), and Wesleyan Retirement Village (n = 48) in Georgetown, Texas. The university's institutional review board approved the study.

Our eligibility criteria were based on a randomized clinical trial (McDougall, Becker, Vaughan, et al., 2010). The eligibility criteria included ability to speak and understand English, no sensory loss or cognitive impairment, and willingness to participate in the study for 2 months. Ability to communicate in English was assessed using a checklist designed for the study. We asked seven questions in this order: Are you able to hear conversations on the phone? Are you able to comprehend English conversations? Are you able to articulate enough to be understood? Are you able to participate in two-sided conversations? Can you decipher concrete and abstract conversational content? Are you able to make an appointment for follow-up testing? Can you repeat back the appointment time and place? If any question was answered incorrectly, the individual was deemed ineligible. Sensory loss was determined by self-report of hearing and vision. Visual and hearing acuity were further evaluated at the "in-person" eligibility screening by evaluator observation and by a self-report checklist developed for the study. The Mini-Mental State Examination (MMSE; Folstein, Folstein, & McHugh, 1975) was used to screen for cognitive impairment. Only those with scores > 23 were eligible to participate in the study.

One hundred thirty-three participants were enrolled in the study and assessed at time 1; 98 (73.7%) were women, 114 (85.7%) were Caucasian, 6 (4.5%) were African American, 2 (8%) were American Indian or Alaskan Native, 1 (8%) was Asian, and 10 (8.5%) identified as another race or ethnicity. Six (4.5%) participants identified as Hispanic. Participants had completed 15.54 years of schooling on average. Their average age was 79.39 (SD = 8.82) years.

Of the 82 participants assessed again at time 2, 59 (72%) were women, 73 (88%) were Caucasian, 2 were African American, 1 was American Indian or Alaskan Native, 1 was Asian, and 6 self-identified as another race or ethnicity. Two participants identified as Hispanic. Participants had 15.54 years of schooling on average. Their average age was 80.56 (SD = 8.82) years.

Intervention

Once participants were screened and consented, they participated in 12 hours (1.5 hours per session $\times$ 8 sessions) of classroom sessions at the study sites. Two sites had multiple cohorts to accommodate the large groups who enrolled in the study. Thus, participants did not leave their retirement community to attend a group at a different facility.

Intervention Design

Memory training sessions were presented in a small group format twice a week for a month. Participants received structured training in topics, including memory and health, memory functions and mechanisms, factors affecting memory for people of all ages, memory beliefs and aging, and use of internal and external memory strategies (McDougall, 2009, 2010). Implementation of the memory training intervention was designed to ensure treatment fidelity in the three areas of delivery, receipt, and enactment, as recommended by the Consortium guidelines proposed by Bellg and colleagues (2004).

Yoga Training

At each site, all participants were also trained in yoga techniques during the first 20–30 minutes of each class, using a combination of ballistic and static stretches that were borrowed from different yoga disciplines. Each class began with seated stretching, in conjunction with focused breathing. “Asana” or postures were modified to each participant’s skill level or overall mobility and physical condition. The yoga portion of the session culminated in a guided meditation, visualization-oriented, relaxation exercise using mountain, river, and ocean scenarios. These scenarios concluded with 10 breaths, counted off by the instructor and performed in unison.

Memory Training

The SeniorWISE (Wisdom Is Simply Exploration) intervention consisted of eight classes for 12 hours of classroom training (McDougall, 2002, 2009). The training was based on the four components of self-efficacy theory: enactive mastery experience, vicarious experience, verbal persuasion, and physiologic arousal. A female septuagenarian role model taught the memory training classes. In each memory class, the first 20–30 minutes were dedicated to principles and practice of yoga. At each session, homework was reviewed, and participants

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were asked to describe memory successes and failures and to write out specific questions that they would like to be answered by the group. A list was made of common problems and concerns. The thoughts and feelings that occurred when participants forgot were discussed, and group reactions to problems and solutions to problems were identified.

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Feedback on performance accomplishments and verbal persuasion was given continually throughout the session. There also was an observer in the classroom to track each individual's performance and mastery of practice activities. The observer debriefed with the instructor and pointed out areas that needed to be reviewed in the next session to prevent the development of poor habits. After each class, participants wrote down some aspect of their learning or an essential point for the day, such as a memory strategy. All classes were interactive, with time for discussion. Participants also practiced the memory strategies that were emphasized in the class. Thirty minutes of practice with memory strategies were allocated during each class to strengthen enactive mastery experience, the strongest component of self-efficacy.

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Our emphasis on brain health in the memory strategy training provided new information to participants. For example, we discussed topics such as antioxidants, confidence building, mental stimulation, physical activity, relaxation techniques, social engagement, and moderate alcohol consumption. On completion of the study, participants received a memory improvement book, *Total Memory Workout: 8 Easy Steps to Maximum Memory Fitness* (Green, 2001).

Outcome Measures

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Outcome measures matched the content of the training. All cognitive and self-report measures were administered at baseline and then at postclass (2 months after baseline).

The Rivermead Behavioural Memory Test—Everyday memory performance was measured with the Rivermead Behavioural Memory Test. The standardized profile score has a range from 0 to 24 and is sometimes interpreted with cutoff points for four levels of memory function: normal (22–24), poor (17–21), moderately impaired (10–16), and severely impaired (0–9). Alpha reliability was .70 in this sample (Cockburn & Smith, 1989; Wilson, Cockburn, Baddeley, & Hiorns, 1989).

Direct Assessment of Functional Status-Extended—Instrumental activities of daily living were measured with the Direct Assessment of Functional Status- Extended (DAFS-E; McDougall, Becker, Vaughan, et al., 2010; McDowd, McDougall, Han, & Gregory, 2010). The DAFS-E measures performance in the following domains: communication skills, financial skills, shopping skills, and medications skills. There are 55 items in the DAFS-E, and 20 of these are in the medication skills domain. The DAFS has shown high interrater and test–retest reliabilities for patients at a memory disorder clinic (English and Spanish speaking) and among normal controls.

Memory Self-Efficacy—Memory self-efficacy was measured with the Memory Efficacy questionnaire (McDougall et al., 2003), a Guttman scale consisting of four questions that address two memory concerns: maintenance skills to prevent decline and use of memory

strategies. Participants make predictions regarding self-efficacy (yes or no) and the strength and confidence of their predictions, ranging from 10% to 100%. Alpha reliabilities have been reported by Lachman (1990) as .57 and .68. Alphas in this sample ranged from .52 to .73.

Spielberger State–Trait Anxiety Inventory—Anxiety was measured with the Spielberger State–Trait Anxiety Inventory. The State–Trait Anxiety Inventory was developed to differentiate the temporary condition of “state anxiety” from the chronic condition of “trait anxiety” in adults (Spielberger, Gorsuch, & Lushene, 1970).

Memory Complaint Questionnaire—Memory complaints were measured with a new scale derived from the 108-item Metamemory in Adulthood (MIA) scale based on a conceptual item analysis and factor analysis with 690 older adults. The complaint subscale consists of 24 items and captures individuals’ perceptions of their memory abilities as generally stable or subject to long-term decline. A higher average item score (>2.5) indicates greater stability and fewer complaints about failing memory (McDougall et al., 2006). Mean scores range from 0 to 5. Alpha reliability in this sample was .77.

Center for Epidemiologic Studies Scale—Depressive symptoms were assessed with the 20-item Center for Epidemiologic Studies Depression Scale (CES-D; Radloff & Teri, 1986). Somatic complaints and depressive symptoms are determined based on an individual’s response to a 4-point Likert scale. Alpha reliability in this study was .79.

Data Analysis

Data were analyzed using SPSS 19.0. There were no missing data. Basic descriptive and bivariate statistics (i.e., Pearson’s *r* correlations) were used to examine patterns of relationships between study variables; alpha was set at .05. Because of the small sample size, no alpha inflation corrections were used.

Results

One hundred thirty-three participants completed the baseline assessment, and 83 participants (62.4%) completed posttest assessments. Fifty individuals dropped out of the study and were not posttested (Table 1). This differential attrition varied among the sites from a low rate of 21% to 31%. Of those individuals who dropped out of the study, 20 completed at least one class, and 30 did not attend any classes. Dropouts had significantly lower scores at baseline on memory performance and instrumental activities of daily living and attended fewer or no classes (Table 2). We did not inquire about chronic illness. On the demographic questionnaire, the participants reported the frequency of primary care and specialty doctor visits. This information has been included in an expanded version of Table 1. There were no differences in either primary care or specialty doctor visits between the completers and the dropout groups.

To ensure that there were no significant differences between participants’ baseline assessment scores between sites, an analysis of variance was conducted to compare scores for participants from each recruitment site. Results yielded no significant differences (see

Table 3). There were some differences in the demographic characteristics of participants from the different recruitment sites. At baseline, participants recruited from the Lyons site were significantly younger than those from all other sites ($M_{\text{age}} = 67.33$ years, $SD = 8.72$ years). Participants recruited from the Westminster site ($M_{\text{age}} = 83.64$ years, $SD = 6.23$ years) and Wesleyan sites ($M_{\text{age}} = 84.63$ years, $SD = 4.88$ years) were significantly older than participants from the RBJ site ($M_{\text{age}} = 76$ years, $SD = 9.91$ years). In addition, participants recruited from the RBJ site had significantly fewer years of education ($M_{\text{years}} = 14.98$, $SD = 2.58$) than those from the Westminster site ($M_{\text{years}} = 7.14$, $SD = 2.36$). Participants from the Westminster site completed significantly more classes ($M_{\text{years}} = 8.55$, $SD = 1.06$) than those from either the Lyons site ($M_{\text{years}} = 7.22$, $SD = 0.83$) or the Wesleyan site ($M_{\text{years}} = 6.27$, $SD = 2.51$). Participants from the Westminster and Wesleyan recruitment sites were more likely to be Caucasian, and participants from RBJ were more likely to be African American, than participants for all other sites.

We used pairwise deletion to account for missing data. Paired-samples *t* tests of baseline and posttest assessment scores were calculated to evaluate the impact of the memory training intervention on participants' memory, functioning, mood, and functioning in instrumental activities of daily living (IADLs). Results indicated significant increases in participants' memory self-efficacy scores from baseline ($M = 59.77$, $SD = 21.17$) to posttest ($M = 71.72$, $SD = 18.99$; $t(79) = 5.39$, $p < .05$; Table 3).

An increase in scores was also observed on the Rivermead Behavioural Memory Test from baseline ($M = 14.86$, $SD = 4.25$) to posttest ($M = 16.93$, $SD = 5.01$; $t(82) = 5.04$, $p < .05$) and on DAFS scores from baseline ($M = 48.43$, $SD = 5.61$) to posttest ($M = 50.34$, $SD = 5.11$; $t(81) = 3.84$, $p < .05$). For all significant increases, calculated eta-squared statistics indicated large effect sizes (Table 4). In addition, participants' scores on the CES-D decreased significantly from baseline ($M = 10.06$, $SD = 7.76$) to posttest ($M = 8.26$, $SD = 7.20$; $t(80) = 3.02$, $p < .05$) after the intervention, suggesting mood improvement. There was a marginally significant increase on memory complaints from pretest ($M = 2.88$, $SD = 0.39$) to posttest ($M = 2.95$, $SD = 0.39$; $t(82) = 1.99$, $p < .05$). Calculated effect sizes indicated that all significant changes were large effects. Scores on anxiety and cognition, however, did not significantly change from baseline to posttest.

On the Rivermead Memory Performance Test, 13 individuals increased their scores from poor to normal performance, and seven improved from impaired to poor memory performance (Table 5). Thus, after the intervention, there was a significant reduction in memory-impaired individuals by 37%. Among the 83 participants who completed posttests, 15 individuals were in the normal memory performance category, a 650% change in the positive direction. With the individuals who moved from the impaired to poor memory performance, there was an increase of 26% from 27 to 34 individuals in the poor memory group. The moderately impaired performance group at baseline decreased to 36%, from four participants at baseline to 28 individuals. The severely impaired memory performance group at baseline dropped to 40%, from 10 to 6 individuals at posttest.

Discussion

In this study, we tested the hypothesis that older adults with everyday memory performance problems who participated in 12 hours of the SeniorWISE-based memory training intervention and yoga would show significant improvements from baseline to postintervention. Among this group of octogenarians who completed the training and posttest, the improvement in memory performance was significant both clinically and statistically. We saw a change in 40 (48%) participants who increased their performance from one memory performance group to another group at posttest.

In a previous test of the SeniorWISE memory training, we found that, at posttest, 24 (29%) adults made this level of performance improvement within the Rivermead memory function groups (McDougall, Becker, Vaughan, et al., 2010). The original SeniorWISE study recruited community-residing older adults in Central Texas. The major difference in this current study from the original study was the demographic variable of age. In this study, participants were significantly older with a M_{age} of 80.56 ± 8.82 versus 74.69 ± 5.74 years. Other investigators have also found significant improvement in memory performance in octogenarians ($M_{\text{age}} = 80.9$ years) who participated in a mental fitness/healthy lifestyle program with 12 hours of training (McDougall, 2002; Miller et al., 2012).

It is possible, of course, that the improvement in memory performance was because of practice and retest effects (Rabbitt, Diggle, Holland, & McInnes, 2004; Wilkinson & Yang, 2012). Hindin and Zelinski (2012) have validated the practice theory in a recent meta-analysis of 42 studies, and Salthouse (2012) recommends using multiple measures of change on parallel versions of the same tests. However, the Rivermead has four versions of the test, so practice effects were unlikely to produce the large gains we saw in memory performance. More than likely, these individuals were highly motivated to participate in the training and make improvements.

SeniorWISE is based on self-efficacy theory (Bandura, 1991), and the application phase of each memory training class enabled participants to consolidate skills covered in earlier stages and to identify any problems, which the instructor addressed. After 30 minutes of lecture, with time for questions and answers, an additional 30 minutes were allocated to enactive mastery experience. Our female septuagenarian role model, a licensed psychologist, taught the memory training classes. Other memory training programs based on the self-efficacy framework have also produced successful outcomes (Payne et al., 2012; West et al., 2008). All of these intervention programs include elements designed to increase self-efficacy, which are woven into class discussions and homework assignments, and provide opportunities to develop mastery. We also found a significant decrease in CES-D scores.

There was a significant increase in memory complaints. Memory complaints, defined as everyday memory problems, show a variation of approximately 25%–50% in the published literature. Memory complaint was measured with items primarily derived from the change subscale of the MIA Questionnaire. Among the factors we extracted, the content of one in particular seemed to reflect a concern with declining memory function (McDougall & Vaughan, 2013). Although closely related to the preexisting change subscale of the MIA,

this factor also included items from the locus, capacity, anxiety, and achievement subscales. Memory complaints are serious indicators of cognitive decline and deserve to be evaluated with psychometrically sound measures. Perhaps because of their learning, these adults realized that they would continue to have trouble with everyday memory.

The significant increase in scores on performance-based IADLs at posttest was another notable improvement, clearly indicating the transfer of learning. In a previous study, using the extended version of the DAFS, we tested IADLs with older adults with everyday memory impairment and older adults with normal memory performance scores (McDougall, Becker, Vaughan, et al., 2010; McDowd et al., 2010). Those in the memory-impaired group had significantly lower DAFS-E scores than adults with normal memory performance scores. The older adults in that previous study were, on average, 77 years old and had 15 years of education, whereas in this study, participants were, on average, 81 years old but had comparable years of education. There were no statistically significant differences in years of education between the adults in this current study and the participants in the SeniorWISE study.

Yoga is a popular mind–body exercise phenomenon used to reduce anxiety and stress, general well-being, health conditions, and chronic illness (Li & Goldsmith, 2011; Oken et al., 2006; Rocha et al., 2012). The addition of yoga was a novel aspect of the memory training experience for our participants. An earlier study with healthy seniors found no improvements in cognitive function from either Hatha yoga or exercise (Oken et al., 2006). However, the combined memory training and yoga intervention had the added benefits of a combined intervention that significantly improved memory performance and reduced depressive symptoms among the participants in the current study. The octogenarians who participated in this unique intervention were able to draw on the cognitive reserve that allowed them to overcome their everyday memory difficulties (Winblad et al., 2004).

Several limitations should be noted. A group of highly motivated volunteers who were Caucasians and well-educated individuals represented our study. Therefore, the findings are not generalizable to all older adults. Thirty-seven percent ($n = 50$) of the sample dropped out before completing the posttest. In addition, the dropouts may not have desired to attend 12 hours of classes. Retention at the four sites varied from 68% to 79%. This may have assured that the training worked, producing a robust effect. The study design was quasiexperimental and did not have a comparison group other than those individuals who were screened and tested but dropped out. Our measure of cognitive impairment, the MMSE, was a global screening measure. The average MMSE score of those who completed the intervention was 27. Although not impaired, this score was midway between normal and impaired. Thus, the global MMSE may not be sensitive enough. Nevertheless, there were no significant differences in MMSE scores of those who dropped out and those who completed the study. The Rivermead provided variance in everyday memory performance scores and was sensitive to change. Nevertheless, this study of a combined intervention of brain training based on the “use it or lose it” philosophy with yoga shows the benefits of maintaining healthy brain function and boosting brain plasticity.

Implications for Neuroscience Nursing

According to Webb (2000), neuroscience nursing is a unique nursing discipline that addresses the needs of individuals with biopsychosocial alterations because of nervous system dysfunction. Neuroscience nurses with advanced practice credentials facilitate conduct, promote the utilization of research activities, develop education strategies, and evaluate the effectiveness of educational interventions (American Association of Neuroscience Nurses, 2009). The study that tested a memory training intervention plus yoga training with community-residing older adults showed the benefits of a multifactorial intervention with adults coping with everyday memory difficulties. The combined treatments offered a unique model for brain health programs and the promotion of nonpharmacological treatment with the goals of maintaining healthy brain function and boosting brain plasticity.

Holistically, such memory interventions and yoga may be used in conjunction with other strategies to improve cognition and well-being in older adults. Vance, Eagerton, Harnish, McKie-Bell, and Fazeli (2011) developed a protocol in which nurses and other healthcare providers can create individualized cognitive prescriptions for their patients. Using motivational interviewing techniques, specific individualized behavioral goals are developed with patients in several areas that support cognitive reserve and brain plasticity including intellectual exercise, physical exercise, mood support, social support, nutrition, and sleep hygiene. For example, a patient may have concurrent goals (e.g., [a] avoid caffeine after dinner to help improve sleep quality, [b] eat salmon twice a week for the omega-3-fatty acids) with the ultimate goal of improving brain health and cognitive functioning. Clearly, memory training and yoga can be easily incorporated within these individualized cognitive prescriptions for those with an interest in these activities. In fact, memory training and yoga may be used in combination with other behavioral techniques (i.e., improved sleep protocols) to help older adults experience successful cognitive aging.

Acknowledgments

We acknowledge the St. David's Community Health Foundation for funding.

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TABLE 1.

Baseline Demographic Scores Between Completers and Dropouts

Variables	Range	Completer Group (N = 83), % or M ± SD	Dropout Group (N = 50), % or M ± SD	χ^2 or (F)
Age (years)	53–96	80.56 ± 8.821	77.48 ± 9.790	(3.210)
Gender				0.803
Male		27.7	24.0	
Female		72.3	76.0	
Race/ethnicity				3.821
African American		2.4	8.0	
Caucasian		88.0	82.0	
Other		9.6	10.0	
Years of education	9–25	15.54 ± 2.57	15.51 ± 2.936	(0.004)
Marital status				10.492
Never married		3.6	4.0	
Married		20.5	30.0	
Divorced		16.9	28.0	
Separated		–	2.0	
Widowed		56.6	32.0	
Freq. of primary care visits				11.589
Never		1.9	0.0	
Only as needed/unspecified		6.0	12.0	
Less than once yearly		1.2	0.0	
Once yearly		22.9	24.0	
Every 6 mo./twice yearly		36.1	22.0	
Every 2–4 mo./3–6 times yearly		26.5	26.0	
More than 6 times a year		3.6	16.0	
Freq. of specialty doctor visits				7.441
Never		10.8	4.0	
Only as needed/unspecified		26.5	26.0	
Less than once yearly		0.0	0.0	
Once yearly		21.7	16.0	

Variables	Range	Completer Group (N = 83), % or M ± SD	Dropout Group (N = 50), % or M ± SD	χ^2 or (F)
Every 6 mo./twice yearly		18.1	28.0	
Every 2–4 mo./3–6 times yearly		19.3	14.0	
More than 6 times a year		3.6	12.0	

Note. Freq. = frequency; mo. = months.

TABLE 2.

Baseline Scores on Study Variables Between Completers and Dropouts

Number of classes attended	0–10	7.63 ± 1.429	2.11 ± 3.363	167.075 ^{***}
Memory self-efficacy	0–100	59.77 ± 21.170	60.59 ± 18.135	0.059
Memory complaints	0–5	2.88 ± 0.39	2.92 ± 0.42	0.370
Rivermead memory	0–24	14.86 ± 4.252	13.20 ± 4.703	4.177 [*]
Cognitive functioning (MMSE)	0–30	27.17 ± 2.224	26.52 ± 2.628	2.135
Depression (CES-D)	0–80	10.06 ± 7.763	9.09 ± 6.830	0.514
Spielberger State Anxiety	20–80	46.55 ± 3.811	47.64 ± 4.292	1.986
Spielberger Trait Anxiety	20–80	47.23 ± 4.431	47.95 ± 4.398	1.210
Instrumental activities of daily living	32–55	48.43 ± 5.611	45.70 ± 7.324	5.376 [*]

Note. Instrumental activities = Direct Assessment of Functional Status; cognition = Mini-Mental State Examination (MMSE); depression = Center for Epidemiological Depressive (CES-D); everyday memory = standard profile score from the Rivermead Behavioural Memory Test; memory complaints = Memory Complaints Inventory from the Metamemory in Adulthood Questionnaire; memory self-efficacy = Memory Efficacy Questionnaire; anxiety = Spielberger State and Trait Anxiety.

^{*} $p < .05$.

^{***} $p < .001$.

TABLE 3.

Differences in Demographic Baseline Scores Between Recruitment Sites

Variables	Range	RBJ (N = 23), % or M ± SD	Lyons (N = 13), % or M ± SD	Westminster (N = 24), % or M ± SD	Wesleyan (N = 48), % or M ± SD	“Unassigned” (N = 25), % or M ± SD	χ ² or (F) (20.613)*** 1.647
Age	53–96	76.50 ± 9.179	69.31 ± 9.481	83.83 ± 5.998	84.63 ± 4.880	72.64 ± 9.287	
Gender							
Male		26.1	38.5	29.2	25.0	20.0	
Female		73.9	61.5	70.8	75.0	80.0	
Race/ethnicity							55.808***
African American		4.3	–	–	4.2	12.0	
Caucasian		65.2	92.3	100.0	95.8	68.0	
Other		30.3	7.7	–	–	20.0	
Education	9–25	14.98 ± 2.58	15.00 ± 2.082	17.667 ± 2.914	15.146 ± 2.350	15.56 ± 3.401	(4.325)**
Marital status							30.370*
Never married		4.3	15.4	–	2.1	4.0	
Married		8.2	38.5	16.7	22.9	40.0	
Divorced		34.8	38.5	8.3	6.3	40.0	
Separated		–	–	–	–	4.0	
Widowed		43.5	7.7	70.8	66.7	12.0	
Classes	0–10	7.04 ± 2.585	7.22 ± 0.833	8.55 ± 1.057	6.27 ± 2.516	0.40 ± 2.000	(10.704)**
Memory self-efficacy	0–100	61.55 ± 20.364	60.33 ± 20.204	58.02 ± 20.978	59.48 ± 19.399	60.74 ± 20.311	(0.105)
Memory complaints	0–5	2.84 ± 0.42	2.95 ± 0.50	2.95 ± 0.47	2.90 ± 0.34	2.84 ± 0.36	(0.412)
RBMT	0–24	13.30 ± 4.986	14.92 ± 4.536	14.17 ± 4.687	14.90 ± 4.101	13.20 ± 4.690	(0.898)
MMSE	0–30	26.22 ± 2.593	27.77 ± 2.619	26.71 ± 2.458	27.40 ± 2.029	26.40 ± 2.754	(1.695)
CES-D	0–80	11.43 ± 10.668	11.15 ± 7.515	9.33 ± 5.990	8.55 ± 5.671	10.28 ± 7.368	(0.792)
State Anxiety	20–80	46.87 ± 3.794	46.31 ± 3.683	47.46 ± 3.799	46.79 ± 3.941	47.60 ± 4.592	(0.354)
Trait Anxiety	20–80	47.04 ± 3.772	45.38 ± 3.969	46.92 ± 4.880	47.34 ± 4.039	49.12 ± 4.910	(1.804)
DAFS-E	32–55	45.52 ± 7.513	50.77 ± 6.340	47.29 ± 5.894	48.13 ± 5.394	46.29 ± 7.630	(1.721)

Note. Instrumental activities = Direct Assessment of Functional Status (DAFS); cognition = Mini-Mental State Examination (MMSE); depression = Center for Epidemiological Depressive (CES-D); everyday memory = standard profile score from the Rivermead Behavioural Memory Test (RBMT); memory complaints = Memory Complaints Inventory from the Metamemory in Adulthood Questionnaire; memory self-efficacy = Memory Efficacy Questionnaire; anxiety = Spielberger State and Trait Anxiety.

$p < .001$

 $p < .01$
**
 $p < .05$
*

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TABLE 4.

Intervention Effects on Memory, Mood, and IADL Scores ($N = 83$)

Variables	Range	Preintervention ($M \pm SD$)	Postintervention ($M \pm SD$)	t (df)	Sig.	η^2
Memory self-efficacy	0–100	59.77 $\pm$ 21.170	71.72 $\pm$ 18.991	5.392 (79)	.000	0.272
Memory complaints	0–5	2.88 $\pm$ 0.39	2.95 $\pm$ 0.39	1.99 (82)	.050	0.046
Rivermead memory	0–24	14.86 $\pm$ 4.252	16.928 $\pm$ 5.012	5.038 (82)	.000	0.239
Cognition (MMSE)	0–30	27.17 $\pm$ 2.224	27.458 $\pm$ 2.624	1.085 (82)	.281	0.014
Depression (CES-D)	0–80	10.06 $\pm$ 7.763	8.26 $\pm$ 7.199	–3.020 (80)	.003	0.103
STAI: State Anxiety	20–80	46.55 $\pm$ 3.811	46.59 $\pm$ 4.924	0.069 (81)	.946	0.000
STAI: Trait Anxiety	20–80	47.23 $\pm$ 4.431	46.88 $\pm$ 4.153	–0.723 (77)	.472	0.007
DAFS-E: instrumental activities	32–55	48.43 $\pm$ 5.611	50.342 $\pm$ 5.114	3.841 (81)	.000	0.156

Note. IADL = instrumental activity of daily living; instrumental activities = Direct Assessment of Functional Status (DAFS); cognition = Mini-Mental State Examination (MMSE); depression = Center for Epidemiological Depressive (CES-D); Rivermead memory = standard profile score from the Rivermead Behavioural Memory Test; memory complaints = Memory Complaints Inventory from the Metamemory in Adulthood Questionnaire; memory self-efficacy = Memory Efficacy Questionnaire; anxiety = Spielberger State and Trait Anxiety (STAI).

TABLE 5.

Memory Performance Groups at Baseline and Posttest (*N* = 83)

Memory Performance Groups	Time 1	Time 2	Change
Normal	2	15	+650.00%
Poor	27	34	+25.93%
Moderately impaired	44	28	−36.36%
Severely impaired	10	6	−40.00%

Note. Everyday memory performance was measured with the Rivermead Behavioural Memory Test. The standardized profile score (SPS) has a range from 0 to 24 and is sometimes interpreted with cutoff points for four levels of memory function: normal (22–24), poor (17–21), moderately impaired (10–16), and severely impaired (0–9).