MEMORY TRAINING IN ADULTHOOD:
CHANGING MEMORY AND SELF-REGULATION

By

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To Joan Scully and to individuals ever concerned about their cognitive performance

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Everyday memory ability – such as learning and remembering names – is highly valued by people of all ages, yet is known to decline normatively with increasing age, when related non-ability self-regulatory factors, such as self-evaluative beliefs and effective strategy selection, are also at increased risk. Collective results from cognitive interventions demonstrate that memory can be improved at any age, but controversy surrounds the true value of these programs in terms of the scope and duration of training-related gains. A traditional and common approach to cognitive interventions for adults is memory strategy training, and limited work of this type has examined whether self-regulatory factors might benefit from these programs or moderate other training-related gains. Further, while interventions focused on intensive practice or core capacity training have demonstrated near transfer – after training, performance improves on untrained tasks related to the target task – evidence of near transfer from strategy training programs is very rare.

The present research addressed both self-regulation and transfer issues. Could a short-term training program, focused on strategy training, lead to changes in beliefs and strategy usage, as well as score gains? Would a short program emphasizing self-

regulatory change be more effective than a program focused solely on strategy-training? Would near transfer be possible if both performance and self-regulation changed as a function of training?

Overall, this research demonstrated that a brief name recall strategy training program is effective for middle-aged and older adults. The training program constituted two hours of in-person instructor-led training and approximately two to three hours of continued self-study at home. After training, as compared to pretest data and as compared to inactive waitlist control participants, trainees demonstrated improved name recall memory, higher levels of memory self-efficacy, and more effective use of memory strategies. Contrary to expectations, benefits from training were similar for a beliefs-focused strategy training approach, as compared to a content- and duration-matched training approach without the focus on beliefs. However, benefits from both training approaches extended beyond the targeted name recall task that was trained to performance on similar, but untrained, associative memory tasks.

CHAPTER 1
INTRODUCTION TO MEMORY TRAINING

Need for Memory Training

Older Americans constitute a growing segment of the population, and adults aged 65 years or older today can expect to live another 20 years, on average (Federal Interagency Forum on Aging-Related Statistics, 2012). While the quantity of these additional years is obviously desirable, the quality of living during this time may lack productivity and pleasure due to memory difficulties, both subjective and objective. Older adults rate their memory as highly important to their lives (Dark-Freudeman, West, & Viverito, 2006), and independent living requires a certain degree of memory ability (Berry, Hastings, West, Lee, & Cavanaugh, 2010; Hering, Rendell, Rose, Schnitzspahn, & Kliegel, 2014; Stine-Morrow & Basak, 2011). At the same time, extensive research shows that older adults show normative declines across age in several aspects of memory (Berry et al., 2010; Mather, 2010; Nyberg, Lövdén, Riklund, Lindenberger, & Bäckman, 2012). In older adults, complaints about such memory changes are related to lowered ability to perform activities of daily living and reduced quality of life (Montegjo, Montenergo, Fernández, & Maestú, 2012). Declines in memory (e.g., forgetting names) may determinately impact the quality of social interactions, as well as work and/or volunteer experiences. Older adults, compared to younger adults, are also less likely to successfully employ memory strategies (McDaniel & Bugg, 2012). At the same time, negative stereotypes about aging and memory are pervasive, creating fear of more significant memory loss (Dark-Freudeman et al., 2006). These age changes in memory are problematic and worrisome, although not insurmountable.

Increased research evidence supports the existence of cognitive plasticity in late life, challenging stereotypes concerning the assumed inevitability of memory decline with age. This plasticity enables performance improvement, even in the very old (Hertzog, Kramer, Wilson, & Lindenberger, 2009; Stine-Morrow & Basak, 2011). Indeed, a long-accepted body of work has established that older adults may benefit from memory training (Berry et al., 2010; Gross et al., 2012), although, the *practical* impact of these programs is less well established. Traditional memory training programs demonstrate little transfer of benefit to untrained tasks, longer-term benefits are uncertain, and some memory strategies may be difficult to apply in everyday life (Rebok, Carlson, & Langbaum, 2007; West & Strickland-Hughes, 2015).

One possible explanation is that most programs do not address negative beliefs about memory and aging, which can discourage older adults from investing long-term effort in the memory strategies learning during training (West, Welch, & Yassuda, 2000). The present project addresses this issue: by examining an intervention designed to maximize improvement in memory beliefs, as well as strategies and memory performance. Before describing the methods for the present project, this paper presents an overview of the extant literature on memory training and aging, with a focus on strategy training, the most common approach to aging and memory intervention.

Strategy Training for Episodic Memory

Numerous cognitive interventions over the past half-century have targeted memory improvement in the aged. On the most basic level, these interventions are effective; immediately following training, older trainees perform better on the trained memory tasks than they did before training, whereas control participants do not demonstrate comparable improvements (Gross et al., 2012; Hertzog et al., 2009; West,

2012). At the same time, the promise of improved outcomes via memory training needs to be evaluated in relation to the degree to which everyday memory skills can be improved via training. At present, the overall effectiveness of training varies dramatically across programs that differ along multiple dimensions, such as their design, format, duration, or content. For example, memory training programs have been designed to target core processes, such as processing speed or working memory (via extended practice), to enhance overall cognitive engagement with lifestyle changes, or to provide instruction on memory strategies. The formats of training programs include both in-person classes or training and self-study programs to complete at home. Program content might be delivered via paper-and-pencil or technology such as video recordings, computers, or video games. Participation in these programs may last a few hours or a few months. Some programs train a single memory strategy or practice a single activity; multifactorial programs include multiple types of activities and may supplement strategy content with information about normative aging and memory changes or practice in non-strategy techniques, such as focused attention (Hering et al., 2014; Rebok et al., 2007; Stine-Morrow, Parisi, Morrow, Greene, & Park, 2007; Zehnder, Martin, Altgassen, & Clare, 2009).

Training benefits are examined by comparing performance levels before and after a specific memory intervention. However, observed pre-post improvements may be credited to factors other than the memory intervention. For example, performance commonly improves from repeated testing or additional exposure to specific tests and measures, gains which are known as practice effects (Ball et al., 2002; Hertzog et al., 2009). Further, performance gains could result from aspects of the intervention other

than the active ingredient (i.e., practice or strategy training), such as social interaction or changes in motivation and outcome expectations (Boot, Simons, Stothard, & Stutts, 2013; Stine-Morrow & Basak, 2011). To address these alternative explanations for pre-post gains and to test for specific training-related performance improvements, pre-post performance of trainees can be compared to that of control groups. Control groups complete the same assessments on the same schedule as the trainees but do not complete the target training or intervention activities. In such designs, the effect of training is represented by pre-post improvements specific to trainees, above-and-beyond any gains demonstrated by control groups. Random assignment of participants to training or control conditions, such as in randomized control trials, establishes comparable groups representing the population of interest (Boot et al., 2013). Without an appropriate control group, the internal validity of an intervention study is suspect and interpretation of pre-post gains is limited.

Control groups may be inactive or active. An inactive control group typically completes the same interviews as trainees, but has no training meetings or other activities. Waitlist control groups are inactive, but are scheduled to complete the training program following all assessments. Comparison to inactive/waitlist groups controls for effects of practice from repeated testing. Active control groups will hold meetings and/or participate in activities that are distinct from the target training. Their sessions are matched to training along dimensions related to time, number of meetings, and/or opportunities for social interaction. In this way, comparison to active control groups can further control for level or type of activity, social experience, motivation, and other aspects of participation such as the laboratory environment or trainees' expected

performance gains. For example, compared to memory strategy classes, botany lectures may be matched in instruction style, difficulty of the course material, and duration and frequency of class meetings.

Active control groups may be placebo or non-placebo. Placebo groups are active but participate in activities which should not benefit or otherwise influence the outcome of interest. Non-placebo control groups participate in a different type of training program (e.g., exercise versus strategy classes), different versions of a training program (e.g., self-study versus instructor-led), or different training approaches or formats (Bailey, Dunlosky, & Hertzog, 2010; Dunlosky, Kubat-Silman, & Hertzog, 2003; Hastings & West, 2009; Stine-Morrow et al., 2014).

Impact of Strategy Training

Cognitive interventions target memory improvement for middle-aged and older adults because episodic memory (e.g., learning new names, recalling a story) is highly valued and fundamental to daily life, yet declines with increased age (Dark-Freudeman et al., 2006). Accordingly, the success of such an intervention can be judged by whether it reliably enhances memory performance. Fortunately, over half a century of research demonstrates these programs are successful using this metric: episodic memory performance of middle-aged and older adults is typically better following training than before training, even when accounting for practice effects with appropriate control groups (Berry et al., 2010; Gross et al., 2012; Stine-Morrow & Basak, 2010).

Evidence from Meta-Analyses

Meta-analyses establish that strategy training programs for older adults are successful in enhancing memory performance. The meta-analyses reviewed here focused on memory and mnemonic training. However, notable evidence from other

systematic reviews on cognitive interventions suggests mature adults may benefit from computerized and video game interventions (Kueider, Parisi, Gross, & Rebok, 2012; Toril, Reales, & Ballesteros, 2014) and training core capacities, such as attention or working memory (Morrison & Chein, 2011). For memory, meta-analyses have examined training effects relative to inactive control groups or active placebo groups, or included studies without control groups, as noted below.

An early meta-analysis of mnemonic training for older adults confirmed greater gains for trainees compared to active and non-active control groups (Verhaeghen, Marcoen, & Goossens, 1992). As an initial examination of the overall potential of mnemonic training, this report focused on pretest to posttest comparisons but included training programs which did not employ control groups. Overall pretest to posttest change was greater for trainees than for the available control participants. In addition, gains were greater for programs using group training, rather than individual training. Interventions incorporating pretraining, such as relaxation training or other non-mnemonic instruction, showed higher gains than those without pretraining. However, gains were unaffected by the type of strategy trained or the content of the pretraining (Verhaeghen et al., 1992). These principal findings regarding episodic memory benefit from intervention have been replicated.

With colleagues, Gross completed a meta-analysis involving 35 studies that examined memory training conditions for older adults (without pharmaceuticals or other intervention, such as exercise), in comparison to control conditions (Gross et al., 2012). The overall effect of training across these studies was significant: objective memory performance improved across assessments more for individuals who received training

than for those who did not complete training. As in the previous meta-analysis, the impact of training was unaffected by the particular strategies that were trained. Further, the report documented that an intervention offering only one strategy typically shows weaker effects than an intervention which provides training on many strategies.

A review of cognitive intervention programs for older adults conducted by Zehnder and colleagues (2009) reported less promising findings than those reported by other reviews. They considered programs for adults with mild cognitive impairment, as well as for healthy older adults. Similar to the previous meta-analysis (Gross et al., 2012), pre-post improvements in episodic memory performance were greater for trainees than for inactive control participants across the reviewed studies. In particular, positive impact of mnemonics training was found for paired associates learning and verbal recall. However, pre-post improvements in memory were not superior for trainees when compared to active control groups. One possible interpretation is that non-specific training effects contributed to memory gains, as pretest to posttest comparison of memory performance was similar for memory trainees and active control groups. However, Zehnder and colleagues broadly defined active control groups, including alternative interventions (e.g., relaxation) and combined programs in which memory was trained along with other intervention activities (e.g., exercise). Thus, their supposition that memory gains from strategies training may not exceed that derived from active control groups should be interpreted with considerable caution.

Collective evidence from meta-analyses confirm that memory training for older adults can effectively improve episodic memory performance. The “take home messages” from these reviews are many. Training is effective for people who are over

60 years of age. Participation in cognitive interventions is better than doing no intervention activity. More training, with varied activities, is better than less training and with fewer types of exercises, and group training programs are more effective than individual programs. It is also important to note that the benefits to episodic memory from training programs may be derived from aspects of the interventions that are not specific to the targeted training activities, considering that the effectiveness of these programs does not seem to vary in relation to the particular strategies that are trained. Evidence from specific experimental training programs can be used to document the global effects reported in these meta-analyses.

Evidence from Experimental Paradigms

Reports from experimental studies provide additional understanding of the memory enhancement that comes from cognitive training. As mentioned, intervention designs vary greatly. In this section, several experimental studies are reviewed as examples to demonstrate the fact that existing interventions vary greatly in length and approach to training. In particular, these studies highlight the potential for memory gain from varied programs.

ACTIVE trial

The Advanced Cognitive Training for Independent and Vital Elderly (ACTIVE) trial was a randomized clinical trial for older adults. The project was large-scale, including over 2,800 participants. Training was completed in six U.S. cities using a single-blind approach (Ball et al., 2002; Rebok et al., 2014; Willis et al., 2006). Participants completed a large battery of cognitive tests and surveys several times, and assessments continued over ten years. The ACTIVE trial compared three different training conditions. In this way, each training group served as an active, non-placebo

control group for the other training groups. Memory training and associated memory performance outcomes are of interest here.

Memory trainees (*n* = 711) attended ten classes, for about an hour each week. During each small group session, participants learned or practiced strategies, such as forming mental associations or visual images, received feedback, and completed practice tests varying in ecological validity. Strategies were introduced in the first five sessions and were further practiced in later sessions. Thus, the memory training program of the ACTIVE trial extensively trained multiple strategies. The target ability for memory training was verbal episodic memory (e.g., list or story recall; Ball et al., 2002).

Overall, the ACTIVE intervention resulted in improvements in episodic verbal memory for older adults and seemed to attenuate expected decline over time due to normal aging. However, the observed benefits for memory trainees were considerably less robust than trainees in the reasoning or speed of processing groups (Ball et al., 2002; Ball, Edwards, & Ross, 2007; Rebok et al., 2014; Willis et al., 2006). More than one-fourth of the intervention participants showed significant change in memory scores after training. Performance on the verbal memory tasks was better for memory trainees than the other groups one year and two years following training (Ball et al., 2002). In contrast, memory training-related benefits for verbatim story recall were transitory, as they were demonstrated immediately after training but were diminished at the one year follow-up (Sisco, Marsiske, Gross, & Rebok, 2013). Maintenance of training-related gains is discussed in detail later.

Using a sample of older individuals with subjective memory complaints, Cohen-Mansfield and colleagues (2014) replicated the ACTIVE memory training program, with

minor revisions, in another randomized control study. In this study, benefits from the ACTIVE memory program were directly compared to benefits from two comparable cognitive intervention programs – one that focused just on participation and one that focused on general health and wellness. The health promotion program included structured classes and homework on topics related to health behaviors and aging. The participation-centered course was formatted like a book club on memory strategies and promoted goal-setting and supportive group interactions. All participants completed a baseline assessment before training. The timing of assessments and training was staggered such that some intervention groups served as waitlist comparison groups for others who received training earlier. Cognitive functioning was assessed objectively with a battery of assessments that included measures of episodic memory (verbal and non-verbal).

Importantly, cognitive functioning was better following the training program for all groups. While all groups improved objectively on the global cognition score, the ACTIVE training group, but not the other groups, reported reduced subjective memory complaints, representing trainees' impression of their everyday memory experiences. Subjective memory gains may be an important antecedent for objective performance improvement (Crumley, Stetler, & Horhota, 2014), as discussed in more detail later. The subjective memory gains exclusive to the ACTIVE training group may be explained by the relatively greater face validity and social validity of this condition compared to the others. Overall, the data from the ACTIVE study, and its replication, revealed gains in beliefs about ability as well as changes in episodic memory performance.

EMC project

Another exemplar cognitive intervention is the Everyday Memory Clinic (EMC) project (West, Bagwell, & Dark-Freudeman, 2008), which focused on training strategies for several types of episodic memory tasks. Participation in this training program lasted five weeks, and the program was multifactorial, in that trainees completed several different types of exercises and activities, above and beyond strategy instruction. These included attention training, as well as readings on normative age-related cognitive changes. Adults over 50 years old trained on multiple mnemonics through weekly group meetings, homework, and practice (in class and at home). EMC is most remarkable for its focus on improvement in self-efficacy (e.g., confidence in one's memory ability) as a vehicle for training-related memory gains (West et al., 2008; West & Hastings, 2011). All training activities were designed to increase trainees' confidence in their ability. Episodic memory performance (name, list, and story recall) and memory beliefs were evaluated on three occasions, before and after training, and one month later.

Compared to the performance of a waitlist control group, performance of the trainees improved after training and at follow-up testing one month later, for both name recall and story recall. Robust training effects were not apparent for list recall. List recall is relatively less challenging than the other two recall tasks, and supportive external aids are effective and easy to implement for this particular memory demand (Mather, 2010; McDaniel & Bugg, 2012). EMC trainees were perhaps more motivated to focus on improving the more difficult tasks, and control participants may have performed well on list recall tasks without training.

In addition to improved name and story recall performance, strategy use was more effective for trainees compared to control participants, as indicated by self-report

strategy lists following each memory task (West et al., 2008). Training gains were greater for trainees who were classified as “active” than for trainees who were classified as “inactive” (Bagwell & West, 2008). Activity was assessed by individual compliance with intervention assignments and quantity and quality of participation. Further, a follow-up report evaluated benefits from a self-help training condition wherein trainees completed a workbook version of the EMC intervention at home (Hastings & West, 2009). Recall memory improvement was greater for the self-trained group than for the non-active control group.

In sum, cognitive interventions for older adults strive to enhance episodic memory, as a potential key to prolonged independent living and enhanced quality of life. Collectively, as reported in meta-analyses, training interventions can successfully enhance memory performance. In addition, the experimental evidence from specific intervention programs documents the potential benefits of strategy training. Both the ACTIVE trial and the EMC program trained groups of older adults on multiple mnemonics over fairly long periods. The ACTIVE trial was a traditional, yet extensive, intervention focused on training strategies. The EMC program was multifactorial and also included a novel focus on self-efficacy (discussed in more detail later). Importantly, the success of these programs document the potential for episodic memory gain via mnemonics training.

CHAPTER 2
GENERALIZATION AND TRANSFER OF TRAINING

The primary concern of memory training is whether it may effectively enhance memory performance. However, the *practical* impact of memory training for older adults is potentially much broader. In particular, generalization and transfer of benefit are important mechanisms for creating broader impact. Generalization occurs when training provides benefits for broader cognitive, social-emotional, or physical abilities, promotes engaged, healthy lifestyles, or improves general well-being (Hertzog et al., 2009; Stine-Morrow & Basak, 2011). More limited transfer effects are specific training-related gains in non-trained cognitive tasks.

Barnett and Ceci (2002) recommend classifying transfer effects according to the content of the learned and transfer skills (e.g., level of specificity or similarity of trained tasks to transfer tasks) and the context of transfer (e.g., time since training). With respect to specificity, near transfer effects are improvements in performance on tasks closely related to the trained ability, such as gains in visuospatial working memory when verbal working memory is trained. Far transfer effects are improvements in performance on tasks which are less closely-related to the trained ability, such as enhanced reasoning ability after episodic memory training (Zelinski, 2009). Transfer can also vary along a temporal dimension, with near transfer reflecting benefits within a week or month of training (West et al., 2008) and far temporal transfer reflecting gains that can be maintained over months or even years (Rebok at el., 2013).

The practical impact of specific training programs, in terms of both types of transfer, is controversial. Some scholars argue that broad generalization of benefits from specific training programs is assumed, despite limited evidence for near or far

transfer. This criticism is coined the “generalist assumption” (McDaniel & Bugg, 2012; Salthouse, 2006). However, the “generalist assumption” is debated (cf., Fisher, 2012). Failure to find transfer is often reported in training reviews even though the benefits of cognitive intervention may extend beyond specifically-trained memory tasks (Hertzog & Dunlosky, 2012; Kliegel & Bürki, 2012; Zelinski, 2012). More importantly, much of the variance in the research evidence for transfer may be related to inconsistencies in the definition and assessment of transfer (Fisher, 2012; Zelinski, 2009).

Regardless of the categorization of generalization and transfer effects, assessment and explanation of these benefits are integral to maximizing the practical impact of cognitive interventions. Generalization and transfer are important because they increase the value (e.g., benefit per investment in training) of interventions and improve the daily lives of trainees (Barnett & Ceci, 2002; Zelinski, 2009). In the specific context of cognition and aging, benefits to non-trained abilities may stave off age-related attenuation in cognition (Zelinski, 2009). Therefore, generalization and transfer are an important goal of memory interventions for older individuals.

Generalization and transfer are commonly assessed via a comparison of outcomes of interest (e.g., survey responses, task performance) between trainees and control participants. The first step is to identify scores for cognitive performance on the non-trained tasks or reported levels for general aspects of function (e.g., depression, neurogenesis) in both groups. Comparison to control groups is essential for understanding the magnitude of change. For example, maintenance, rather than improvement, for trainees may be consequential if control participants demonstrate deterioration in a targeted ability (Hertzog et al., 2009). Utilizing active comparison

groups who participate in alternative training programs may further allow for extensive evaluation of transfer effects, if the targeted training outcomes differ between the intervention groups. For example, the ACTIVE trial compared performance on a battery of cognitive tests across groups of older adults receiving focused training in memory, reasoning, or speed of processing (Ball et al., 2002; Rebok et al., 2014). Thus, memory performance represented a direct training effect for the memory group but a transfer effect for the reasoning and speed of processing groups.

Generalization

Looking at the evidence for generalization, diverse outcomes may profit from cognitive training and these outcomes may protect against normal age-related declines. Generalization has been demonstrated to some non-cognitive outcomes such as social support (Fried et al., 2004), increased neural activation (Carlson et al., 2009), daily function (Rebok et al., 2014; Willis et al., 2006), and other indicators of well-being and health (Cohen-Mansfield et al., 2014; Fried et al., 2004). For example, cognitive interventions have led to changes in feelings of loneliness or depression, (Cohen-Mansfield et al., 2014), and the latter could be a risk-factor for dementia (Ownby, Crocco, Acevedo, Vineeth, & Loewenstein, 2006). Brain aging (e.g., increased white matter abnormalities, dysfunction such as over- and under-recruitment, decreased volume and grey matter) is also hypothesized to explain normal cognitive decline with aging (Hayes & Cabeza, 2008). With increased evidence of neuroplasticity, even in late life, engaged lifestyles and participation in cognitive interventions may promote neurogenesis (Park & Bischof, 2013). Ultimately, the benefits from cognitive interventions may broadly generalize to overall health and well-being. Participation in the ACTIVE trial predicted improved functionality and ability to perform activities of daily

living after five years, although these effects were not evident immediately following training (Rebok et al., 2014; Willis et al., 2006). Notwithstanding this evidence for generalization, there are relatively few studies focused on broad generalization of training effects and considerably more work needs to be done.

Transfer to Untrained Tasks

The evidence suggestive of broad generalization of training is complemented by evidence concerning specific transfer to non-trained cognitive tasks. Successful transfer is evident when core capabilities are trained; these training paradigms involve intensive practice (e.g., 20 or more hour-long training sessions over several weeks) of specific information processing skills, such as working memory or visual attention (Zelinski, 2012). As compared to control groups, trainees with extensive working memory practice often exhibit gains in higher-order cognitive processes, such as reasoning and composite scores of general fluid intelligence (Morrison & Chein, 2011). Interestingly, these gains in fluid intelligence from core capacity training are dose-dependent, with increased benefit from longer or more intensive training programs (Jaeggi, Buschkuehl, Jonides, & Perrig, 2008).

Cognitive training via computer or video games represents a comparable training paradigm to extensive practice of core capacities in that important cognitive processes (e.g., focused attention, processing speed, working memory) are well exercised by video game play (Hertzog et al., 2009). Video game training is effective for older adults; across 20 studies analyzed in a meta-analysis, pre-post improvement in several cognitive performance outcomes (e.g., memory, reaction time, attention) was greater for video game trainees than control participants (Toril et al., 2014).

Thus, several different training paradigms appear to promote transfer effects, particularly for general cognition or fluid intelligence, but transfer from strategy training on one type of memory task to another type of memory task is rare (Charness, 2007; Fisher, 2012). In the future, it would be important to focus on the specific conditions that promote transfer, that is, the *how* and *when* of transfer, particularly those conditions that make it possible for trainees to improve their everyday memory function (West, 2012).

Temporal Transfer

Temporal transfer represents gains from interventions that persist over time. Cognitive interventions may work as inoculations. A “vaccine model” of cognitive interventions proposes that a single training dose should sufficiently protect against cognitive decline, with little need for additional “boosters.” Doubtful that the “vaccine model” reflects the impact of cognitive interventions, Hertzog and colleagues (2009) propose:

> One-shot inoculations, however intensive, may not be as effective as creating contexts in which newly trained procedures are reinforced by contact with trainers and others, communication about challenges to implementing the procedures in everyday life, and instruction in how to overcome those challenges by adapting trained procedures to contextual variations. (p. 45)

That is, lasting gains from cognitive interventions are likely promoted by continued cognitive exercise and related behavior changes, as in a physical intervention.

Sparse empirical evidence tests these alternative models of temporal transfer in cognitive interventions. Little is known about temporal transfer, or how long the benefits of training are maintained or sustained. Few intervention studies test and report long-

term training outcomes; most programs report only immediate training gains or those within one month or a year of training (Gross et al., 2012). Thus, documenting temporal transfer would be critical for establishing the practical value of training.

Evidence from some studies suggests a regression to baseline performance following initial training-related performance boosts. For example, comparison of pretest memory with performance three years following strategy training revealed declines in everyday memory performance (specifically, face-name associations and grocery store shopping lists) for trainees, compared to no significant change for the inactive control groups (Scogin & Bienas, 1988). That is, trainees did not maintain their initial training gain, as their performance returned to pretraining level.

In another study, maintenance of memory gains was assessed two years following training of memory strategies (11 sessions, 90 minutes each), using a battery of everyday memory tasks and self-report measures of related beliefs (Bottiroli, Cavallini, & Vecchi, 2008). As before, trainees exhibited initial gains from training, but these gains were largely diminished two years later, when performance was comparable to initial levels. Exceptionally, gains in face-name associative memory were maintained over the two years. This specific long-term maintenance is noteworthy because face-name associative memory is highly challenging, especially with advancing age (Strickland-Hughes, West, Smith, & Ebner, 2016).

As with the maintained face-name associative memory performance, a few other interventions demonstrated lasting memory gains beyond a year following training. Stigsdotter-Neely and Bäckman (1993) report long-term follow-up data for two of their intervention studies. In particular, they evaluated maintenance of training effects for 3.5

years. Both studies compared an 8-week-long, multifactorial training program focused on encoding strategies, attention, and relaxation to inactive control groups and alternative training programs. Participants in the multifactorial training conditions exhibited relatively better recall memory than the other groups. In one study, multifactorial trainees demonstrated improved performance at 3.5 years compared to 6 months after training. The other two groups maintained but did not improve their performance level over this time. In the other study, participants in each of the three groups demonstrated no change in performance from 6 months to 3.5 years following training. However, performance was greater for the multifactorial trainees than the other two groups at the 6 month posttest. Thus, some interventions demonstrated maintained memory gains but others did not. Importantly, each of these studies examining long-term impact had small sample sizes and may have been under-powered.

The first long-term assessments of training benefits with a large sample were reported by the ACTIVE trial, which tested over 2,800 participants up to ten years after training (see 1 and 2 year data in Evidence from Experimental Paradigms). Participant retention rates following training were 67% after a 5-year delay (Willis et al., 2006) and 44% after a 10-year delay (Rebok et al., 2014). Analyses were conducted using intent-to-treat procedures. Memory performance was improved five years following training for trainees from all conditions (memory, speed, and reasoning training), as compared to performance before training (effect size for difference in untrained control group was 0.23 SD; Willis et al., 2006). Latent growth curve analyses examining the slope of change in a memory composite score further indicated memory performance may improve through year five (Rebok et al., 2013). Interestingly, this gain was unaffected by

participation in “booster sessions” (follow-up training intended to promote maintenance of gains) that were completed by a subset of trainees one year after initial training. While maintenance of gains through year five was suggested, neither the memory training nor the booster sessions were related to significant performance gains one decade after training. (Rebok et al., 2014). The initial large-scale, long-term evidence for training benefits from ACTIVE are promising, but additional longitudinal research is warranted to understand the potential for temporal transfer from cognitive interventions.

In sum, the collective evidence from cognitive interventions show great promise in extending benefits to the everyday life of older adults. Generalization has been evidenced in that non-cognitive tasks may benefit from training regimens, and, importantly, these outcomes are often related to cognitive health. Transfer to cognitive tasks, such as attention and fluid intelligence, is also evidenced by training programs (Hertzog et al., 2009; Toril et al., 2014). Long-term transfer over 5 years has also been established. Thus, benefits from cognitive interventions show specific transfer and broadly extend beyond specifically trained memory tasks to practical and relevant skills, abilities, and outcomes. In particular, one benefit of cognitive interventions may be enhancement of self-regulation. This evidence will be considered in the next chapter.

CHAPTER 3
SELF-REGULATION AND TRAINING

While improved performance is the ultimate goal of memory training programs, the role of self-regulatory factors in intervention is of increasing importance to clinicians and scholars of cognitive aging. The social-cognitive theory of self-regulation proposes that personal, behavioral, and environmental factors, as well as their interactions, collectively determine performance above and beyond individual ability factors (Bandura, 1997; Nelson & Narens, 1990). Self-regulation occurs when individuals responsively and effectively *adapt*, after evaluating the personal and environmental factors relevant to a particular challenge. Thus, successful self-regulation involves maximizing one's performance outcomes through knowledge/awareness of task demands, one's capabilities, and the social/environmental consequences of task-related actions. Self-regulation, in the context of memory, can be seen as involving strategy selection (e.g., picking those strategies that seem suited to the task and one's own capabilities), as well as beliefs about one's potential and capability with respect to cognitive tasks.

In a self-regulatory context, self-evaluative beliefs (judgment or appraisal of self and individual capabilities) and metamemory (knowledge about memory and memory strategies) are important elements of self-regulation. Consider two examples which respectively demonstrate the self-regulatory influence of self-evaluation and metamemory. In the first example, an older man's confidence in his memory ability increases after he receives positive feedback from practice levels of a memory game (Strickland-Hughes et al., 2016). This more positive self-evaluation promotes sustained effort during subsequent memory challenges, and he is more likely to attempt harder

game levels. In the second example, when faced with the challenge to remember names of new acquaintances at a party, an older woman considers the mnemonics she knows and recruits the most suitable strategy (Hertzog & Dunlosky, 2012). As she continually judges how well she has learned each new name, she invests less effort in practicing the names she has already learned and more effort in learning the ones she hasn't yet mastered. Both of these examples highlight the potential for self-regulatory processes to maximize memory outcomes.

Self-Evaluative Beliefs and Training

Memory-related self-evaluative beliefs are central to well-being, broadly, and to cognitive health, specifically. More positive self-evaluative beliefs are related to greater quality of life (Montegjo et al., 2012) and lower levels of depression (Floyd & Scogin, 1997). This self-regulatory factor can even predict late-life mortality (Wiest, Schüz, & Wurm, 2013). More relevant to the present research, more positive self-evaluative beliefs are related to better concurrent and future memory performance (Beaudoin & Desrichard, 2011; Crumley et al., 2014; Valentijn et al., 2006). These documented relationships support the notion that beliefs affect the way in which individuals approach information processing tasks. Age differences in self-evaluative beliefs are often reported in the literature (West & Strickland-Hughes, 2015) and the link between self-evaluation and performance strengthens with age (Agrigoroaei, Neupert, & Lachman, 2013; Blanchard-Fields, Horhota, & Mienaltowski, 2008). Given these relationships, it is likely that self-evaluative beliefs play a central role in self-regulation during task performance.

Two important questions regarding self-regulation are pertinent to the study of cognitive interventions for the aged. *Do cognitive interventions enhance self-regulatory*

factors? To what extent are training-related memory gains strengthened or sustained by self-regulatory factors?

Research evidence suggests memory-related self-evaluative beliefs benefit from cognitive interventions. Floyd and Scogin (1997) completed a meta-analysis of 27 memory training studies. Their analysis focused on subjective measures, specifically metamemory assessments and other indicators of subjective memory, such as performance predictions. With an average participant age of about 70 years old (total N = 1,150), their analysis showed a significant effect (d = .19). This effect suggested that memory training improves subjective memory measures absolutely. At the same time, subjective memory improvements were smaller than improvements observed in objective memory scores, and interventions emphasizing beliefs showed stronger effects on subjective indicators. Later experimental research suggests that memory training may enhance self-evaluative beliefs and that these beliefs in turn predict or explain training-related gains on cognitive outcomes.

Both the ACTIVE study and EMC project, described previously, measured change in beliefs. One of these self-regulatory beliefs was personal locus of control for memory, a sense that one can improve memory through personal effort. Memory control beliefs are related to enhanced memory performance and intellectual function across the lifespan (Agrigoroaei & Lachman, 2010). Although memory control beliefs generally decline with increasing age (Lachman, Neupert, & Agrigoroaei, 2011), they may be modifiable through instruction, even in late life (Hastings & West, 2011; Lachman, Weaver, Bandura, Elliott, & Lewkowicz, 1992).

Level and change in memory control beliefs were measured in the ACTIVE study. When examined five years after training, the likelihood of improved memory control beliefs was considerably greater for reasoning and speed of processing trainees than the inactive control group (Wolinsky et al., 2009), despite no particular emphasis on these beliefs in the training program. Unfortunately, this control beliefs change did not extend to the ACTIVE *memory* trainees, although a replication study evidenced trainee improvements in subjective memory (Cohen-Mansfield et al., 2014). Personal locus of control for memory is a self-regulatory factor that we hope to positively influence in the current study.

Training-related gains in memory self-efficacy beliefs are also central to this proposal. Self-efficacy beliefs are one's personal assessment of individual capabilities in a specific domain. Bandura (1997) posits that motivated behavior, task persistence and task success are regulated by self-efficacy. In turn, self-efficacy derives from enactive mastery, vicarious experience, verbal persuasion, and physiological and affective responses. The design of the EMC project included several elements to maximize these four influences on self-efficacy. For example, self-efficacy elements in the EMC project included opportunities to experience in-class success remembering names of other class members (enactive mastery), small group discussions of the homework questions (vicarious experience), provision of positive feedback from the trainer within the classes and on first posttest scores (verbal persuasion), and an emphasis placed on learning, not on scoring 100% (physiologic and affective states; West et al., 2008). One month following the intervention, EMC trainees reported increased memory control beliefs and greater levels of memory self-efficacy, whereas the control participants reported

declines in these beliefs. These EMC project results provide stronger evidence of the possible benefit of training to beliefs than that reported by the ACTIVE trial. Trainees who completed an at-home self-study version of the EMC project, which provided only limited exposure to elements designed to enhance self-efficacy, demonstrated enhanced memory control beliefs, but no memory self-efficacy gains, following the training program (Hastings & West, 2009). Thus, changes in memory self-efficacy may require greater group interaction to provide more opportunities for vicarious experience and verbal persuasion.

This evidence suggests that cognitive interventions may promote enhanced self-regulation, particularly self-evaluative beliefs. Do self-regulatory factors, in turn, predict greater cognitive performance within the context of interventions? In the Senior Odyssey program (Stine-Morrow et al., 2014), an inductive reasoning intervention, higher initial levels of memory self-efficacy predicted greater gains in inductive reasoning (Payne et al., 2012). That is, trainees with more confidence in their memory spent more time on training activities and demonstrated greater training-related improvements. Similarly, “active” versus “inactive” status of participants in the EMC study was explained by baseline memory self-efficacy, as well as level of education and subjective health, according to discriminant analysis (Bagwell and West, 2008). Further, training-related change in memory self-efficacy was a direct predictor of memory gains from the intervention as assessed using latent growth curve modeling (West & Hastings, 2011). Importantly, “active” trainees demonstrated greater gains in memory self-efficacy than did inactive trainees (Bagwell & West, 2008). These findings underscore the

importance of enhanced self-evaluative beliefs in promoting training gains in memory performance.

Metamemory

Research evidence suggests that cognitive interventions may enhance metamemory and that cognitive interventions which promote metamemory may be effective in promoting training-related memory gains and transfer effects (Hertzog & Dunlosky, 2012). Metamemory is defined as one's knowledge about memory (Hertzog & Hultsch, 2000). This knowledge can be general (e.g., how memory functions; differences between memory loss in dementia and in healthy aging) or personal (e.g., comprehension of one's own capabilities). General knowledge about memory strategies, identifying the most effective personal strategy for a specific task situation, monitoring of one's performance, and consequently adapting information processing to task demands are metamemory processes involved in cognitive self-regulation (Hertzog & Dunlosky, 2011).

Aging may impact the effectiveness of strategy selection: older adults are less likely than younger adults to spontaneously employ memory strategies, and they may overly rely on external aids or familiar mnemonics (McDaniel & Bugg, 2012). Therefore, research paradigms relevant to metamemory and cognitive training have focused on selection and application of memory strategies as well as self-monitoring techniques (Berry et al., 2010). The focus here will be on strategy selection.

Increased strategic knowledge and more effective strategy application is often assumed to underlie performance benefits from training (West et al., 2000). Limited data examines this assumption, due in part to the challenges of directly assessing strategy use – as when using think-aloud procedures – and related validity concerns (West &

Strickland-Hughes, 2015). One way investigators might assess effectiveness of strategy use is by providing explicit instruction to use a specific strategy, and then assuming these instructions were closely followed to the best of the participants' abilities. In this case, memory performance following strategy instructions becomes a proxy of the strategy's effectiveness (Gross & Rebok, 2011).

Subjective evaluation of strategy selection can be measured using self-report questionnaires of various formats (e.g., open-ended, multiple choice, checklist) administered after memory testing (West & Strickland-Hughes, 2015). A review of 12 interventions that included subjective evaluations of strategy selection computed standardized pre-post gains in strategy use between trainees and control participants. The effect size for strategic behavior gain for trainees was 1.86 (Gross & Rebok, 2011). The review suggests that strategy improvement was greater for 97% of trainees, compared to control participants, in these studies. The EMC project (Bagwell & West, 2008; West et al., 2008) was one of the interventions included in this analysis.

Strategy selection was assessed using self-report surveys in the EMC project (West et al., 2008). Immediately following list, name, and story recall tasks, participants indicated which strategies they had used by selecting from a list of commonly used strategies, with an open-ended option to list any idiosyncratic techniques they had employed. These checklists were completed during pretest and posttest assessments immediately following training and one month later. Over time, trainees and control participants had a tendency to spontaneously increase the number of strategies used. More importantly, trainees, but not control participants, also transitioned to more effective use of the strategies over time. Therefore, the EMC project demonstrated that

strategies may be increased and optimized via participation in a multifactorial intervention program. Furthermore, the methodology employed in EMC to assess strategies required participants to be self-aware of strategy usage, that is, to be aware of strategy selection and implementation as part of their self-regulatory approach to task success.

Strategy selection, at least for list recall tasks, may also be evaluated by examination of clustering techniques. A benefit of this approach is that it does not require participants to self-report use of strategies after testing, which requires high levels of metamemory and task monitoring (Gross & Rebok, 2011). The key to measuring clustering is to examine word recall order. That is, the order in which participants recall list items might be evaluated for items recalled in order of the study list (serial clustering, suggesting use of association strategies) or items recalled in categorical groupings (semantic clustering, suggesting use of categorization), or (3) consistent use of a particular recall order across trials (subjective clustering, suggesting use of consistent or idiosyncratic strategies). Use of serial, semantic, and subjective clustering techniques by memory trainees and control participants were analyzed in the ACTIVE trial (Gross & Rebok, 2011). Trainees immediately increased in their use of each clustering technique, and these gains were maintained over five years. Further, this training effect was present regardless of various participant demographic characteristics, such as age and years of education.

This evidence suggests that older adults may be more likely to successfully and frequently employ memory strategies as a consequence of training. In turn, effective strategy selection may directly enhance memory performance. It is possible for trainees

to learn how to monitor themselves and then adjust attention and revise strategy use according to judgments of their own learning or modify their approach based on the particular needs of a specific task situation (Dunlosky et al., 2007; Hertzog & Dunlosky, 2011). If this is not done, memory strategies learned in the laboratory cannot easily be applied to everyday life (Mcdaniel & Bugg, 2012). In the EMC program, there was a tendency for participants to use simpler strategies, and few trainees indicated using all the steps of the more complex strategies (West et al., 2008). Therefore, even when strategy use increases, strategies might not always be applied in the most effective manner to promote memory on a particular task. For example, compared to the overall training effect for strategic behavior reported by Gross and Rebok (2011), the magnitude of training effect for memory performance was considerably smaller.

Unlocking the maximum potential of benefit from cognitive training requires participants to generalize strategic knowledge, that is, to take strategies learned in one context and apply them more broadly. To this end, the limited research evidence is very hopeful. For example, older adults learned two mnemonics (i.e., sentence generation and interactive imagery) and practiced them to recall lists and paired associates (Cavallini, Dunlosky, Bottiroli, Hertzog, & Vecchi, 2010). Trainees successfully generalized use of these mnemonics to a novel, unpracticed text memory task when simply instructed that the strategies might be helpful for other memory tasks. In contrast, performance on the novel task did not improve for trainees who did not receive this instruction. Via training, individuals may better understand which mnemonics are most effective for themselves or may more effectively pair appropriate strategies to

specific situations (Hertzog & Dunlosky, 2012; Hertzog & Jopp, 2010). In this project, strategy selection was a key target variable for change during training.

CHAPTER 4
THE PRESENT STUDY

Over five decades of research on episodic memory training confirm that older adults may benefit from these programs: trainees, compared to control groups, demonstrate improved performance on trained tasks immediately following training (Gross et al., 2012). Consistent with a self-regulatory perspective, proposed mechanisms of training-related memory gains include superior self-evaluative beliefs, such as memory self-efficacy and personal locus of control for memory (Payne et al., 2012; West & Hastings, 2011), and enhanced metamemory, such as effective strategy selection and implementation (Bailey et al., 2010; Gross & Rebok, 2011; Hertzog et al., 2009). These potentially critical self-regulatory factors were the focus of this research.

An established, award-winning memory training program—the Everyday Memory Clinic (EMC) project (West et al., 2008)—was used as the foundation for this research to enhance the potential for important lessons to be learned from this work. The EMC project was a multifactorial memory training program for adults age 50 or older. The design of the EMC project incorporated several elements to enhance memory self-efficacy across four known influential sources (i.e., mastery experience, vicarious experience, verbal persuasion, and physiological and affective states; Bandura, 1997; Smith & West, 2006). Compared to waitlist control participants, EMC trainees demonstrated pretest-posttest gains in name recall, story recall, memory self-efficacy, memory control beliefs, and strategy use. Latent growth curve modeling (West & Hastings, 2011) suggested memory self-efficacy played a key role in trainees' overall memory performance and in enhancing memory: level of memory self-efficacy predicted story recall and name recall performance, and gains in memory self-efficacy predicted

gains in story recall. Thus, the EMC project was highly successful and highlighted the value of a focus on self-regulation in strategy training.

However, the precise value added from the focus on self-efficacy is unknown, because EMC combined an emphasis on self-regulatory beliefs with multifactorial memory training. That is, the intervention focused on strategy training plus beliefs and did not separately examine the impact of these component elements from strategy training per se. The present research – Everyday Memory Clinic-Revised (EMC-R) – was designed to address this limitation and extend previous findings by evaluating the precise impact of beliefs-focused training. Ultimately, this project aimed to maximize the impact of memory training for older adults.

Specific Aims

The global purpose of the EMC-R research was to determine the impact of a relatively brief one-week version of a memory intervention that emphasizes strategy training plus self-regulation, in comparison to a control group and a traditional approach focused on strategy training by itself. The research also examined value-added for the self-regulation condition, in comparison to the traditional approach. Value-added was operationalized by greater change in primary outcomes, and by better transfer to untrained memory tasks. The primary outcomes included name recall and self-regulatory factors – memory self-efficacy, memory control beliefs, and strategy selection.

Aim 1. Effectiveness of Abbreviated Training Dosage

The first aim of the present research was to determine whether a one-week multifactorial training program focused on strategies for name recall is

effective (i.e., yields improved primary outcomes immediately following training in comparison to an inactive waitlist control group).

While successful, the original EMC project was somewhat exacting and relatively lengthy: training covering multiple strategies for list, story, and name recall, lasted over five weeks and included homework and readings outside of class meetings (West et al., 2008). EMC-R aimed to extend EMC project results by examining whether a briefer training dosage could produce meaningful gains. Evidence suggests that relatively brief memory training programs can enhance performance on specifically trained memory tasks (Dunlosky et al., 2003; Gross et al., 2012; Rebok & Balcerak, 1989; West, 1989). Further, meta-analyses on memory training suggest that multifactorial programs, with activities such as relaxation or attention training, may be generally more successful in enhancing memory than strategy-only programs. Also, programs that train multiple strategies may be more effective than programs that train single strategies (Gross et al., 2012; Verhaeghen et al., 1992). The present research determined whether an abbreviated one-week training program can be successful in improving memory and enhancing beliefs. In EMC-R multiple strategies were taught, but for name recall only (not for list or story recall), and training included several different types of in-class and at-home exercises. Thus, EMC-R was multifactorial, but had a relatively short duration (one two-hour training session plus approximately 2 hours of homework). To examine Aim 1, pretest and posttest scores for the primary outcomes were compared to evaluate the impact of training against the impact of repeated testing in the control group.

Aim 2. Impact of Beliefs-Focused Training

The second aim of EMC-R was to determine whether a beliefs-focused strategy training condition compared with a matched strategy training

condition without the focus on beliefs yielded greater improvement for primary outcomes, from pretest to posttest.

This research aimed to define the benefits derived from the EMC project's focus on enhancing self-regulation. Considering evidence from the EMC project and other research, scholars recommend a focus on enhancing self-regulation as part of memory training (Berry et al., 2010; Dunlosky et al., 2007; Hertzog et al., 2009; Rebok & Balcerak, 1989; West & Strickland-Hughes, 2015). Unfortunately, the precise benefit from a self-regulatory focus in memory training is unknown. Limited previous research, such as the EMC project, has compared self-regulation-focused training to inactive control groups (Bailey et al., 2010; West et al., 2008) or to an alternate program focused on health behaviors without mnemonic instruction (McDougall et al., 2010). Other research has examined the relationship between training-related performance gains and self-regulatory factors, such as positive self-evaluative beliefs, in programs that were not specifically designed to enhance self-regulation (Jaeggi, Buschkuehl, Shah, & Jonides, 2014; Payne et al., 2012). No research to date has compared an EMC-style training program, specifically designed to enhance self-regulatory factors, with a traditional, strategy-only program matched in frequency, duration, and strategy content. Comparison of these matched groups in EMC-R helped determine the exact value-added from a training methodology designed to enhance self-regulatory factors, in terms of changes in memory, strategy selection, and memory-related beliefs.

Aim 3. Achieving Near Transfer

The third aim of EMC-R was to determine whether beliefs-focused memory training promotes near transfer to untrained memory tasks.

Enhanced self-regulation may also serve as a key to maximizing the practical impact of training. As mentioned, memory training programs evidence success in improving performance on the trained tasks immediately following training. While some intervention techniques, such as extensive practice of processing resources, demonstrate modest success in promoting transfer effects (Jaeggi et al., 2008), the memory strategy training research rarely reports successful transfer, even to tasks very similar to trained abilities (McDaniel & Bugg, 2012; West & Strickland-Hughes, 2015). However, enhancing strategy knowledge (a type of metamemory) via mere instruction promoted successful transfer of benefit (Cavallini et al., 2010), and trainees with a growth mindset, similar to a greater sense of personal control, have exhibited transfer effects in working memory training (Jaeggi et al., 2014). Thus, enhanced self-regulation may facilitate transfer of training benefits (Hertzog & Dunlosky, 2012; Jaeggi et al., 2014; Stine-Morrow & Basak, 2011; Strickland-Hughes & West, 2017). The present research evaluated whether a beliefs-focused program heightened the practical impact of memory training by promoting near transfer. Successful near transfer was tested via comparison of pretest-posttest performance change on two untrained associative memory tasks across trainees in the strategy-plus-beliefs and strategy-only conditions and participants in a waitlist control group.

Experimental Overview

Native English-speaking, community-dwelling men and women aged over 50 years-old were recruited to participate in the study. Additional eligibility criteria included freedom from cognitive impairment (per performance on a telephone assessment) and sensory functioning (hearing and vision) adequate for completing telephone and in-person assessments. Research participants were randomly assigned in blocks to one of

three experimental conditions: (1) a waitlist control group (CT), (2) a traditional strategy-only training group (SO), (3) or a strategy-plus-beliefs training group (SB; the target training group). The two training conditions were matched in terms of strategy content and training frequency and duration and strategy content. Both training conditions focused on strategies for name recall. All training occurred in a single week and took approximately five hours, including one 2-hour in-person training followed by three hours of recommended self-study in a workbook. However, the strategy-plus-beliefs raining condition (SB), but not the traditional strategy-only condition (SO), incorporated several elements designed to enhance self-regulation (i.e., memory self-efficacy, memory control beliefs, strategy selection) in the in-person session and in the workbook.

Training impact was evaluated using assessment of primary outcomes and near transfer effects. The primary outcomes were memory performance on the trained name recall task and self-regulatory beliefs, specifically memory self-efficacy, memory control beliefs, and strategy selection. Based on self-regulatory theories (Hertzog et al., 2009), effective strategy selection was operationalized as use of a greater number of strategies and use of the most effective trained strategy. Transfer effects were evaluated by comparing the three experimental conditions on transfer outcomes, including visual associative memory and verbal associative memory, with both immediate and delayed tests.

Within-person comparisons charted training benefit to primary and transfer outcomes the week before training (Pretest) and immediately following training (Posttest). Participant eligibility, baseline ability factors, and other individual factors were

assessed in a phone interview before any other assessment or training activities. These factors were included to evaluate whether random assignment by block led to comparable groups at pretest.

Hypotheses

Aim 1 Hypotheses

The first aim of the present research was to examine the effectiveness of an abbreviated dosage of strategy training for name recall, by comparing all trainees (SO plus SB) to the waitlist control group (CT). No differences in the primary outcomes were expected between the trained and control groups at pretest, due to random assignment. Interaction effects were expected for each of the primary outcomes. Trainees were expected to demonstrate greater pre-post improvements in each primary outcome (memory and self-regulatory factors) than participants randomly assigned to the control (CT) condition.

Both a main effect and an interaction effect were expected for name recall performance. Due to practice effects, both groups were expected to perform better on the name recall test at posttest than at posttest (*Hypothesis 1a*). However, the trainees were expected to demonstrate greater performance improvement on the name recall test than the control group (*Hypothesis 1b*). An interaction effect was also expected for memory self-efficacy: compared with their pretest reports, the trainees were expected to report higher levels of memory self-efficacy at posttest, whereas the CT group was expected to report decreased memory self-efficacy at posttest, given that memory self-efficacy can decline simply from taking memory assessments (*Hypothesis 1c*). There were no clear predictions for memory control for trainees because there is insufficient study of this variable in past research. However, the CT group was expected to report

no pre-post change in memory control beliefs due to repeated testing (*Hypothesis 1d*). For number of strategies used, similar to name recall performance, a main effect was expected to show that all participant groups used more strategies at posttest than at pretest (*Hypothesis 1e*). However, the trainees were expected to report using a greater number of strategies than the CT group at posttest (*Hypothesis 1f*). Further, as assessed immediately following training at posttest, a greater proportion of trainees than control participants were expected to report using the most effective training strategy (*Hypothesis 1g*). Thus, results were expected to confirm that a short-term training program can be effective in improving memory and enhancing beliefs, even with brief training program.

Aim 2 Hypotheses

The second aim of the present research was to determine the precise value-added to a memory training program from using a training approach designed to enhance self-regulation, as opposed to a traditional, strategy-only approach. With random assignment by block to training conditions, both groups were expected to have comparable levels of these variables at pretest. Considering the preponderance of research evidence implying success of episodic memory training programs, a main effect was expected for pre-post improvement in name recall performance (*Hypothesis 2a*). Further, a qualifying interaction of condition and test was expected. SB trainees were expected to demonstrate greater recall improvements than SO trainees, due to an emphasis on self-regulation (*Hypothesis 2b*).

A different pattern of change than that expected for memory performance was expected for memory self-efficacy, which has been shown to decline simply from taking

assessments (West et al., 2008; West et al., 2003) and to improve from social, but not individual, EMC-style memory training (Hastings & West, 2009). An interaction of condition and test was predicted. At posttest compared to pretest, the SB group was expected to report increased memory self-efficacy and the SO group was expected to report maintained memory self-efficacy (*Hypothesis 2c*).

An interaction of test and condition was also expected for memory control beliefs. The SB trainees were expected to report pre-post increases in memory control (*Hypothesis 2d*). It was not clear whether there would be any changes in memory control beliefs for the SO group. There is little research concerning whether standard strategy training results in any gains in memory control beliefs. Thus, there were no specific predictions for degree of change in control for SO trainees.

A main effect of condition was expected for number of strategies used: both trained groups were expected to benefit from practice effects by using more strategies at posttest (*Hypothesis 2e*). However, an interaction of condition and test was expected for the number of strategies used. Given the self-regulatory elements in the strategy-plus-belief training condition, SB trainees were expected to demonstrate a greater increase in number of strategies used than the SO trainees (*Hypothesis 2f*).

In addition, at posttest, a condition main effect for strategy selection was expected. A greater proportion of trainees in the SB condition were expected to use the most effective trained strategy than those in the SO condition (*Hypothesis 2g*).

Aim 3 Hypotheses

The third aim of the present research focused on the practical impact of memory training, that is, whether benefits to training transfer to untrained tasks, as evidenced by

near transfer to associative memory tasks comparable to the name-face association task that was trained.

The transfer measures were similar in that they assessed associative memory, but they differed in modality and difficulty. The object-location task (delayed matching of objects to locations) was primarily visual, and the occupation-name task (immediate and delayed matching of names to occupations and delayed recognition of correct pairs) was primarily verbal. Although no data compare these tests, based on past results for these individual measures it was anticipated that they would vary from easy to difficult in this order: delayed location recall, delayed occupation-name pair recognition, immediate occupation-name recall, delayed occupation-name recall. It is possible, then, that the relative gain from transfer would vary across these outcomes, but there was insufficient evidence to make a specific prediction about such variation. These different outcomes were included so that the project may inform whether *any* kind of transfer occurred, given general failure to evidence near transfer in past memory strategy training.

We anticipated that SB would be the only group to exhibit transfer, showing greater pre-post gains than the other two groups (SO and CT), who will not differ from each other, in object-location delayed recall (*Hypothesis 3a*), occupation-name delayed pair recognition (*Hypothesis 3b*), occupation-name immediate recall (*Hypothesis 3c*), and occupation-name delayed recall (*Hypothesis 3d*). If confirmed, these hypotheses would suggest that enhancing self-regulation is an effective avenue to facilitate transfer after memory strategy training.

CHAPTER 5
METHODS

Participants

Community-dwelling middle-aged and older men and women of any race or ethnicity were recruited from the Gainesville, Florida, area using newspaper advertisements, existing participant pools, lifelong learning programs, and word-of-mouth. Participants paid a fully-refundable deposit of $25 to receive the training materials, which were valued at $45. The deposit was waived for two participants who did not bring the deposit with them to the training class. If participants decided not to do the training and interviews but returned the training materials, the full deposit was returned. For compensation, when participants completed the research part of the training program (pretest and posttest interviews), their full deposit was returned and they could keep the training materials.

Participant eligibility was screened using an initial interview conducted by telephone. Inclusion criteria for the study were vision, hearing, and English skills adequate to complete the interviews and training, freedom from cognitive impairment, no reported major stroke or head injury in the previous year, more than eight years of education, and age of at least 50 years. Twenty-one individuals completed the phone interview but were ineligible for the study due to performance on the Telephone Interview for Cognitive Status (TICS; Brandt, Spencer, & Folstein, 1998), scoring below the recommended cut-off score of 31, which was suggestive of cognitive impairment. An additional 23 individuals completed the telephone interview but did not participate in any other part of the research program, due to scheduling issues (n = 10), illness (n = 9), death in the family (n = 2), and unspecified reasons (n = 2).

Eligible participants scheduled for the complete research program included 130 middle-aged men and women. Eight of those participants were excluded for inability to follow interview instructions during the in-person assessments. The final sample included 122 participants, of whom 117 completed the entire research program. One participant did not complete the first in-person assessment due to scheduling issues. Four participants did not complete the second in-person assessment, withdrawing after completion of training due to unspecified reasons (n = 2), health issues (n = 1), and lack of interest (n = 1). Two of these participants were assigned to the strategy-only training group, and the other two were assigned to the strategy-plus-beliefs training group, suggesting that the attrition was not due to condition assignment.

Participants who dropped out of the study after the pretest and training session were similar to those who completed the posttest interview. Independent samples t-tests compared mean scores of these two groups for age, self-rated vision, hearing, physical health, and mental health, years of education, number of prescription medications taken regularly, baseline cognitive performance (Telephone Interview for Cognitive Status, Backward Digit Span, RAVLT immediate and delayed list recall), and all primary outcomes and transfer outcomes assessed at pretest. Levene's test was not significant (all p's > .05) for the comparison of any of these measures across both groups, suggesting that the assumption of homogeneity of variance was tenable. Mean scores for participants who dropped out of the study following the pretest interview were comparable to those for participants who completed the posttest interview, except that those who dropped out had lower scores on the Telephone Interview for Cognitive Status (M_{diff} = -2.44, SE = 1.06), $t(120)$ = -2.30, p = .023, rated their correct vision as

poorer (M_{diff} = -1.54, SE = 0.67), $t(119) = -2.27$, $p = .025$, and reported using fewer strategies on the face-name association test (M_{diff} = -10.17, SE = 5.06), $t(119) = -2.01$, $p = .047$, suggesting that ability factors may have influenced this attrition.

The middle-aged and older participants were 51 to 93 years old (M = 73.24 years, SD = 8.31 years), and half of the participants were under 75 years old. Most participants identified as female (78.7%) and as White or Caucasian (91.9%). Participants were highly educated and healthy. Participants' total years of education ranged from 11 to 27, with a mean of 17.33 years (SD = 2.84 years). Self-reported health was assessed with the SF-12 (Ware, Kosinski, & Keller, 1995). Norm-based standardized scores for physical health and mental health are computed to have means of 50 and standard deviations of 10 in the general U.S. population. In the present study, scores for physical health ranged from 18.83 to 64.05, with a mean of 49.04 and standard deviation of 9.35, and scores for mental health ranged from 26.11 to 65.02, with a mean of 54.68 and a standard deviation of 6.58. Participants reported taking an average of 2.66 prescription medications regularly. About one-third (30.8%) of participants reported taking one or fewer prescription medications regularly and only 8.3% reported taking five or more prescription medications regularly. Only 16 participants (13.3%) reported being hospitalized in the previous year.

Recruitment of this sample size was informed by a-priori power analyses conducted in G*Power (version 3.0.10; Faul, Erdfelder, Lang, & Buchner, 2007), and the final sample size was consistent with those used in previous research (Hastings & West, 2009; West et al., 2008). Although effect sizes may decline over time (Open Science Collaboration, 2015) most relevant effect sizes from the EMC project were

large (West et al., 2008). The power derived from this sample size was sufficient to detect medium-large effect sizes in the analyses (e.g., one-way ANOVAs with three groups; repeated measures ANOVAs with two measurements and three groups, with between-repetition correlations for outcomes estimated as r = .40 - .80, based on memory self-efficacy and name recall data from Strickland-Hughes et al., 2016).

Research Design

EMC-R was a memory strategy training intervention for middle-aged and older adults that utilized a randomized control trial design. Based on availability, with no information provided about the type of training they would receive, research participants were scheduled to attend particular testing and training sessions. Research participants were randomly assigned by session “block” to one of three training conditions: a waitlist control group (CT; n = 38), a traditional strategy-only training group (SO; n = 46), or the target strategy-plus-beliefs training group, designed to enhance self-regulatory factors as well as memory (SB; n = 38). Assignment was based on session enrollment to ensure adequate enrollment size in each training class (n = 12 – 20, based on the Everyday Memory Clinic) and led to relatively similar numbers across conditions.

The design of the research was a 2 (time: pretest, posttest) x 3 (training condition: CT, SO, SB) mixed-model design with time as a within-subject variable and training condition as a between-subject variable. Research participants, procedures, and all measures central to the primary research aims and hypotheses are described in detail in the following sections.

Assessment

Procedure

Completion of the research program (e.g., training and in-person assessments) for each participant (i.e., pretest, training, posttest) lasted three weeks. An overview of the research program is outlined in Table 5-1. Before starting the research program, all participants completed an initial telephone interview, which served as an eligibility screening and was used to assess demographics and other relevant control measures, such as cognitive capacity. During the first week of the program, all participants completed the pretest assessment of primary outcomes (i.e., name recall, memory self-efficacy, memory control beliefs, and strategy use). During the second week of the research program, the training groups (SB and SO) completed training, with or without embedded elements to enhance self-regulation, while the waitlist control group (CT) did not participate in any meeting, homework, or other activity. Posttest assessments, matched in type and difficulty to the pretest assessments, were administered in the third week of the training program.

The phone interview initiated the verbal informed consent process and lasted approximately 30-45 minutes. Baseline measures were collected during phone interviews using established measurement tools, known to be reliable and valid for phone administration to older adults. These measures were used to confirm participant eligibility and to assess the similarity of experimental groups produced by the random assignment by block to training conditions. Research assistants audio-recorded the telephone interviews, after obtaining participant consent. All participants consented to the audio-recording of their telephone interview. The recordings were reviewed by Strickland-Hughes and supervisors for quality control purposes.

Procedures for the pretest and posttest assessments were nearly identical, although different versions of memory tasks were administered in a counterbalanced order for participants across all conditions. An abbreviated version of instructions for survey measures and strategy checklists were initially provided at the posttest interview, but the full instructions from the pretest procedures were administered if participants had questions. Pretest and posttest assessments were administered in small group testing sessions (n = 1 – 13) in meeting rooms at the University of Florida campus or public access rooms in the local area. Of the 45 different testing sessions (pretest and posttest), the mean class size was 5.56 participants (SD = 3.63 participants), and five sessions had only one participant scheduled. Testing sessions included participants from across all three training conditions, to ensure that the self-regulatory advantages from the SB group did not carry over into being tested only with “friends” from that same class. Most research assistants conducting the assessment were blind to participants’ training conditions. Carla M. Strickland-Hughes attended 12 of 21 (57%) posttest sessions and Robin L. West attended 1 of 21 (5%) of the posttest sessions. Strickland-Hughes and West were not always blind to participant condition because they conducted the training classes. However, they typically fulfilled the “experimenter” role during the interviews, which had more limited interaction with participants than the “research assistant” role.

The pretest assessment began with written informed consent, followed by administration of paper-and-pencil tasks. Measures assessed at the pretest and posttest assessments examined primary outcomes (i.e., name recall and self-regulatory factors), transfer outcomes (i.e., object-location and occupation-name memory), and a

few exploratory measures. The Pretest and Posttest assessments lasted approximately 1.5 – 2 hours. The complete list of measures, with citations, administered during the phone interview and pretest/posttest assessments appears in Table 5-2, and each measure is described in detail next.

Measures and Materials

Background and control measures

Background and control measures were assessed during the phone interview. Background measures included participants' responses to surveys on medication and supplement use, demographic information (e.g., years of education, gender, date of birth) and ratings of English language ability and sensory function. Additional measures included a screening for cognitive function (Telephone Interview for Cognitive Status; TICS), a test of episodic memory (Rey Auditory-Verbal Learning Test; RAVLT), a test of working memory (Backward Digit Span), and surveys of self-reported health (SF-12), general personal control beliefs (Perceived Mastery), and general beliefs about ones' memory ability (General Memory Evaluation; GME). Each of these measures are known to be reliable and valid if administered over the phone to older adult populations.

Telephone Interview for Cognitive Status (TICS). The Telephone Interview for Cognitive Status (Brandt et al.,1988) is a telephone screening for cognitive impairment designed for older adults. The TICS includes 11 questions, with a maximum score of 41 points. Higher scores indicate better cognitive performance. Example items include asking participants to identify the complete date, their current location, and the first and last names of the American president and vice president. Participants are also asked to count backwards by sevens from 100 five times, to provide antonyms for common words, name specific items, repeat phrases, and tap on the phone five times. The TICS

is highly sensitive and specific, is strongly correlated to performance on the widely-used Mini-Mental State Examination, r = .94, and has strong test-retest reliability, r = .97. Following the guidelines tested by Brandt et al. (1988), participants eligible for the present research scored greater than 30 out of 41, suggesting freedom from cognitive impairment.

Rey Auditory-Verbal Learning Test (RAVLT). The Rey Auditory-Verbal Learning Test (Lachman, Agrigoroaei, Tun, & Weaver, 2014; Lezak, 1995) assesses episodic verbal memory. RAVLT includes immediate and delayed free recall of a list of 15 commonplace nouns, such as *flower* and *school*. During encoding, research assistants read the 15 words, with approximately 1-second pause between each word. Participants were given 90 seconds immediately following encoding to recall as many of the words as they could remember. Following an approximate ten minute delay, participants were given 60 seconds to recall the words again. Scores were calculated as the number of words correctly recalled, ranging from 0 to 15. Higher scores represent better episodic memory performance. Number of intrusions provided were also counted.

Backward Digit Span test. The Backward Digit Span test, adapted from the WAIS-III for use in the Brief Test of Adult Cognition by Telephone (Lachman et al., 2014; Wechsler, 1997), assesses working memory span. Research assistants read strings of digits at a rate of one second per digit. Participants were asked to repeat the digits in the reverse order. Digit span increased from a length of two digits to a length of eight digits. If participants missed the first string at one level (length of string), a second item at that level was administered. The task was discontinued if a participant incorrectly answered both items at a single level. The backward digit span score was

calculated as the longest digit span correctly repeated backwards at least once, with a maximum score of 8. Higher scores represent greater working memory capacity.

Short Form Health Survey (SF-12). Self-reported physical health and mental health were assessed using the Short Form Health Survey (SF-12; Ware, Kosinski, & Keller, 1996). The SF-12 includes twelve items that use various response scales, ranging from dichotomous response options of *Yes* / *No* to 6-point Likert scales. One item assesses overall general health (*In general, would you say your health is*, with responses from 1 = *excellent* to 5 = *poor*), and the other items assess the extent to which persons are limited as a result of physical or emotional problems (e.g., *During the past four weeks, how much did pain interfere with your normal work, including both work outside the home and housework?*, with 5-point Likert scale response options from *Not at all* to *Extremely*). Summary scores for the physical component scale (PCS) and the mental component scale (MCS) were calculated following procedures outlined by Ware and colleagues (1995). These norm-based standardized scores are continuous and calculated to have a mean of 50 and a standard deviation of 10 in the U.S. adult population. Higher values represent better physical or mental health. The internal consistency of the SF-12 was adequate (Cronbach's $\alpha = .81$), consistent with previous research (Strickland-Hughes et al., 2016) although the items were selected to represent several dimensions of physical and mental health and are thus heterogeneous. The SF-12 has good relative validity when compared to a longer form of the health survey and other health criteria and measures (Ware et al., 1996).

Perceived Mastery survey. The Perceived Mastery scale (Lachman & Weaver, 1998) assesses respondents' general sense of personal control. This provided a

baseline score representing a global analog to the domain-specific personal locus of control for memory of interest in this research. The present research used the 5-item version of the Perceived Mastery scale adapted from Pearlin and Schooler (1978) by Lachman and Weaver (1998) and used in the Health and Retirement Study (HRS; http://hrsonline.isr.umich.edu; Hauser & Willis, 2005), a large-scale longitudinal study. Example items include: *When I really want to do something, I usually find a way to succeed at it* and *What happens to me in the future mostly depends on me*. Responses were made using a 6-point Likert scale ranging from 1 = *strongly disagree* to 6 = *strongly agree*. A perceived mastery score was computed as the mean of the responses to these five items (range: 1 – 6). Higher scores represent greater sense of perceived mastery. The scale had adequate internal consistency reliability, Cronbach's α = .78, although this reliability was not as strong as that reported by the 2006, 2008, and 2010 waves of HRS (Cronbach's α = .89 - .90). Internal consistency would not have been higher if any of the items were removed.

General Memory Evaluation survey (GME). The General Memory Evaluation survey (West, Dark-Freudeman, & Bagwell, 2009) assesses global beliefs about memory, comparable to the specific memory self-efficacy measure of interest in this study, and thus represents a baseline score for memory self-efficacy. The three items in the GME concern evaluation of recent memory performance, comparison of one's memory to same-aged peers, and overall satisfaction with recent memory performance. An example item is *How satisfied are you with your recent memory performance?* Participants rate three items using a 7-point Likert scale (e.g., 1 = *very unsatisfied* to 7 = *very satisfied*). An index GME score was calculated by averaging responses to the three

items (range: 1 to 7). Higher scores indicate greater perceived general memory ability. This score had good internal consistency reliability, Cronbach's α = .84, consistent with previous research (Strickland-Hughes et al., 2016).

Primary outcome measures

Primary outcome measures were assessed at the pretest and posttest. The first primary outcome measure was name recall performance on the face-name association memory task, which was the episodic memory task for which strategies were trained. The other primary outcome measures were the self-regulatory factors that were identified as related to episodic memory and expected to benefit from training: memory self-efficacy, memory control beliefs, and strategy use.

Name recall. Memory test procedures for name recall followed EMC procedures and used the same materials (West et al., 2008). Participants completed two levels of the name recall task. At each level, testing of name recall immediately followed encoding of name-face pairs, and participants were aware of the upcoming assessment. At encoding, participants were instructed to study names and faces. The to-be-remembered stimuli were names printed in all capital letters underneath color portraits of ethnically-diverse men and women of all ages, as described in greater detail in West et al. (2008). Name-face pairs were printed four per page and presented in a notebook. An example page is included in Figure 5-1. At testing, greyscale versions of the same portraits were presented in a different order and without names. Participants were asked to write down each person's name under his or her face in their testing packet.

Level 1 of the task included 12 name-face pairs. Participants were allotted one minute for encoding and four minutes for recall. Level 2 of the task was a more challenging version of Level 1. At Level 2, the Level 1 name-face pairs were presented

again, in a new order, with an additional 12 name-face pairs. For the 24 name-face pairs at Level 2, participants received five minutes for encoding and five minutes for recall. This tiered structure of the memory assessment should have allowed for the maximal influence of self-regulatory factors by allowing individuals to invest additional effort over time on the second trial, if willing to do so.

Two different sets of name-face pairs that were of comparable difficulty based on past research (West et al., 2008) and that had similar balances of race, gender, and age of the faces were used. Set assignment was counterbalanced by testing occasion (pretest, posttest) and training condition. Each participant was assigned a different set of name-face pairs at pretest and posttest. The two sets were of comparable difficultly. Name recall performance did not vary according to set of name-face pairs at pretest for Level 1, $t(119) = -1.34$, $p = .182$, or for Level 2, $t(119) = -0.89$, $p = .375$, or at posttest for Level 1, $t(115) = -.56$, $p = .574$, or at Level 2, $t(115) = 0.032$, $p = .975$.

Name recall scores were calculated as the percent of correctly written names at each level. The primary outcome measure of interest was name recall performance on the Level 2 version of the task, given that this level is more difficult and should provide participants greater opportunities to self-regulate their performance. Scoring criteria were strict; for a response to be scored as correct, the exact name needed to be written, and nicknames, similar names, or partial names were not accepted. For example, neither Bob nor Robbie would be scored as correct for Robert. Spelling errors were acceptable if the written name would have been pronounced the same way as the correct name (e.g., Robbert for Robert; Carlie for Carly).

Memory Self-Efficacy Questionnaire (MSEQ-4). Memory self-efficacy strength represents an individual's level of confidence in his or her ability to perform a specific memory task. Memory self-efficacy strength was assessed using the Memory Self-Efficacy Questionnaire-4 (MSEQ-4; West, Thorn, & Bagwell, 2003). MSEQ-4 includes four subscales wherein respondents indicate how confident they are that they can remember names, object locations, shopping list items, and stories. Confidence ratings range from 0 = *I cannot do it* to 100 = *100% sure I can do it* in ten percent increments. Each memory task is rated for five levels of difficulty, for instance, ranging from remembering all 18 shopping list items for a sick friend to recalling only 2 of those items. Participant responses to all 20 items were averaged for a single score of memory self-efficacy strength (range: 0 – 100). Higher scores indicate a greater level of confidence in one's ability to perform everyday memory tasks. The MSEQ-4 had very good internal consistency reliability (pretest Cronbach's α = .93, posttest Cronbach's α = .93).

Personal locus of control for memory. Participants' memory control beliefs were assessed using the Locus subscale of the Metamemory in Adulthood Questionnaire (MIA; Dixon, Hultsch, & Hertzog, 1988). The Locus subscale of the MIA assesses individuals' perceived sense of control over their memory skills and consists of nine items, each answered using a 5-point Likert scale. Example items include *I have little control over my memory ability* and *If I were to work on my memory I could improve it*. A memory control beliefs index score was calculated by averaging all responses. A higher score (range: 1-5) indicated greater sense of personal control over memory ability. The Locus subscale of MIA had adequate internal consistency reliability (pretest Cronbach's α = .73, posttest Cronbach's α = .73), which was consistent with previous

literature (internal consistency reliability with Cronbach's α = .71 - .78 across four studies; Dixon et al., 1988).

Name recall strategy use. Strategy use was assessed using a checklist of 16 strategies for name recall. Using procedures from the EMC project (West et al., 2008), this checklist was administered following Level 2 name recall testing. Participants were instructed to check each memory strategy that they used on the task and to write any idiosyncratic strategies used that were not on the list. Example strategies include *I tried to pick out prominent features* and *I repeated names over and over to myself*. Participants also indicated the one or two strategies that they used the most. The strategy checklist is reproduced in Appendix A.

One dependent variable was number of strategies used. Greater strategy use indicates greater self-regulation because it indicates that participants flexibly employed multiple strategies. Number of strategies used was calculated as the percentage of the 17 listed strategies that were checked. Participant check marks for "other methods" were tabulated only if the accompanying written note described a valid strategy not already included in the checklist.

As in the EMC project, data scored from the strategy checklist also enabled examination of whether participants across the training conditions employed the *most effective* strategies and/or strategies that were taught in the training program. The *most effective* strategies were identified by comparing name recall performance between participants who did and did not use each strategy. The proportion of trainees in each condition who indicated using the most effective strategy as their most frequent strategy used was another indicator of strategy use.

Transfer outcome measures

Transfer outcome measures were administered at the pretest and posttest assessments. Transfer outcome measures were performance on the two untrained, associative memory tasks—object-location visual association and occupation-name verbal association. As these measures were adapted from similar paradigms reported in the literature, test timing and difficulty for this project were fine-tuned with pilot testing. Two forms of each task were developed and counterbalanced across testing occasion and training condition so that participants received a different set of items at pretest and posttest. Posthoc paired t-tests confirmed that the different sets were of comparable difficulty; performance did not vary between the two sets at pretest or posttest for any of the object-location or occupation-name memory tests (all *p*s > .05).

Object-location visual association. Procedures for the object-location visual association memory were adapted from those outlined in West, Welch, and Knabb (2002) and Welch (1998). Location recall was assessed using a matrix array task wherein participants placed 24 pictures of objects (e.g., hat, scissors) in a 3 × 4 picture array representing 12 rooms in a house and then later recalled their own placements. A complete list of the objects, example pictures of objects, and an example room array are included in Appendix B. Participants were given five minutes to place the objects in the array and to study their placements. Objects could be placed in any room with no more than two objects in each room. Following a delay of approximately 40 minutes, participants were allotted five minutes to reconstruct their earlier placements of the objects in the arrays. Research assistants recorded participant placements at encoding and testing using digital cameras. Object-location recall was calculated as the

percentage of objects placed in the same room at encoding and testing. Higher percentage scores reflected better location memory.

Occupation-name verbal association. The occupation-name verbal association task assessed immediate recall, delayed recall, and delayed recognition memory for names paired with occupations. Occupation-name stimuli were adapted from Craigie and Hanley (1997) and James (2004). Two different sets of 30 occupation-name pairs were used. Within each set, half of the occupations were concrete and able to be visualized. Eight of the concrete surnames were occupations (e.g., FARMER), and seven of the concrete surnames were other things that could be visualized (e.g., STONE). The two sets were matched by length of names (letters and syllables) and frequency of names (per data published by the United States Census Bureau from the 2000 Census), as well as general familiarity with the occupations and how easy the concrete names were to visualize, per ratings from an independent sample (N = 14). A complete list of the occupation-name stimuli is included in Appendix C.

Encoding and testing procedures were adapted from Cavallini et al. (2010), and participant instructions for the task are included in Appendix C. During encoding, participants were given six minutes to study 30 pairs of names and occupations. To-be-remembered stimuli were presented in a deck of laminated 4” × 1.5” blue or green index cards with the occupation-name pairs printed in all capital letters. Occupations were centered on the left half of the cards, and surnames were centered on the right half of the cards. Two different orders of the occupations were randomly generated and used for the immediate recall and delayed recall testing, otherwise the administration and scoring procedures were identical. Participants were given four minutes to write the

name that was paired with each occupation on a list of the 30 occupations that they had studied. Occupation-name recall scores were calculated as the percentage of names correctly recalled at each test, using strict coding criteria, as described in the name recall section. Immediate recall testing occurred right after encoding, and delayed recall testing occurred approximately 40 minutes following encoding. Occupation-name delay recognition testing occurred approximately 75 minutes following encoding. During recognition testing, participants were shown a list of 30 occupation-name pairs. All the names and occupations were previously studied, but only half of the names were matched correctly to the occupations. Participants were given three minutes to circle "Yes" or "No" to indicate whether each name was correctly paired with its occupation. A delayed recognition scores was calculated as the percentage of correct hits (pair correct and indicated correct) and correct rejections (pair incorrect and indicated incorrect) out of the 30 trials. Higher percentage correct scores on the immediate recall, delayed recall, and delayed recognition tests indicate better memory performance.

Exploratory measures

The following exploratory measures were administered at the pretest and posttest assessments. These measures were selected because research suggests that they are related to memory performance and/or self-regulation and may benefit from training or moderate training effects, but they were not central to any of the study aims or hypotheses.

Memory anxiety. Memory anxiety, or perceptions of the relationship between anxiety and memory performance, was be assessed with the 14-item Anxiety subscale of the MIA (Dixon et al., 1988). Example items include *I find it harder to remember things when I'm upset* and *I feel jittery if I have to introduce someone I just met*. As with

the Locus subscale of the MIA, item responses were made using a 5-point Likert scale, and an index score was calculated by averaging all responses. A higher score (range: 1 – 5) indicated greater memory-related anxiety. The Anxiety subscale had good internal consistency reliability (pretest Cronbach's α = .87, posttest Cronbach's α = .89), consistent with previous literature (Cronbach's α = .83 - .87 across four studies; Dixon et al., 1988).

Mindful Attention Awareness Scale (MAAS). The State Mindfulness subscale of the Mindful Attention Awareness Scale (Brown & Ryan, 2003) represents the extent to which individuals pay attention to the present moment. Mindful attention may benefit from the strategy training to the extent that name recall strategies aim to focus attention. Participants rated five items using a 7-point Likert scale, anchored at 0 = *not at all,* 3 = *somewhat*, and 6 = *very much.* Example items include *I find myself doing things without paying attention* and *I find it difficult to stay focused on what's happening in the present.* An index score was calculated by averaging the five responses (range: 0 – 6). Higher scores will represent greater attentiveness. MAAS had acceptable internal consistency reliability (retest Cronbach's α = .85, posttest Cronbach's α = .84), although somewhat lower than previous research with a larger sample across adulthood (Cronbach's = .92; Brown & Ryan, 2003).

Subjective Age Identity. Subjective age reflects how old individuals feel. Subjective age may be important for the present research, given the preponderance of negative aging stereotypes about memory and their effects on performance (Chasteen, Kang, & Remedios, 2011; Hummert, 2011). Participants responded to five subjective age identity questions that were adapted from previous research (Kastenbaum, Derbin,

Sabatini, & Artt, 1972) and administered in Strickland-Hughes et al. (2016) by indicating the ages that they feel. They reported their felt age (*At this moment, how old do you feel?*) and desired age (*If you could choose your age, how old would you want to be?*), among others. Proportional subjective age identity scores were calculated using the average of each individual's five subjective age responses, specifically: (Subjective Age – Chronological Age) / Chronological Age × 100. Proportional subjective age identity scores represent the percentage of one's life that he or she feels younger or older than his or her chronological age. For example, if a woman aged 75 years old reported an average subjective age of 50 years, her proportional age identity score would be -33.33, indicating that she feels 33% younger than she is. This measure had strong test-retest reliability, r = .97, and internal consistency reliability, Cronbach's α = .97, in past research (Strickland-Hughes et al., 2016), and adequate internal consistency reliability in the present research (pretest Cronbach's α = .82; posttest Cronbach's α = .82).

Health and memory engagement information. A survey assessing health and memory-engagement non-ability factors that might affect memory performance was administered. This survey was created for the present research, and the pretest and posttest versions are included in Appendix D. The health-related items, such as whether the participant has been hospitalized recently and a list of current medications taken, were collected for post hoc examination in case participants had difficultly following instructions or seemed confused. Memory engagement items included four frequency ratings of memory activities (e.g., *exercise my memory with games or activities not on a computer,* a = *never* to i = *daily*) and reports of participation in other formal memory training programs. An index score was calculated by averaging responses to the four

frequency ratings (range: 1 – 9), with higher scores indicating a greater frequency of engagement in memory-related activities. This scale had weak internal reliability consistency (pretest Cronbach's α = .64; posttest Cronbach's α = .71), which was unsurprising given that each of the items assessed the frequency of discrete memory-related activities.

Training Procedures

Training was completed for the relevant groups (SB and SO) in the second week of the research program. Training duration and strategy content was the same for both training groups. All trainees initially completed a two-hour class with in-person instruction on strategies for name recall led by Carla M. Strickland-Hughes or Robin L. West. Classes were video-recorded to establish quality control and instructor consistency for the program. At the conclusion of the training class, participants received training materials including a written transcript of the training class, additional readings on strategies for name recall, and practice exercises. Using this workbook, trainees were assigned approximately two to three hours of continued self-study as homework. The homework activities were assigned to be completed in the same week as the training class and before the following interview. Trainees were asked to document their training-related activities on a diary form. The homework assignment sheets for both training conditions are included in Appendix E. In addition, trainees were provided lab contact information (phone number and email address) and invited to contact the research team with any questions about the training materials. No participants, in either training condition, contacted the lab with questions about the homework materials.

Training materials for the two groups (SO and SB) did not vary in strategy instruction or practice exercises. That is, the strategy-related content of the readings, examples, and exercises in the initial strategy lessons and workbook were the same for both training groups. All trainees, but not the Control group, learned association and visualization strategies for names paired with faces, such as the image-name-match method, as well as active observation attentional techniques. The image-name-match method involves several steps, with the goal of visualizing an object that represents the person's name (e.g., can for Ken; a dollar bill for Bill) next to an exaggerated version of a prominent or distinctive facial feature. The instructor explained each strategy, modeling its use and providing several examples, then trainees practiced each technique during in-class activities. For example, each trainee came up with an association for his or her own name and shared with the group, and trainees practiced using all steps of the image-name-match method with several novel face-name pairs. The printed training materials included a written transcript of the training class, additional readings on name recall strategies, e.g., the *How to Remember Names* chapter from "Memory Fitness over 40" (West, 1985), and several practice exercises for recognition and recall of faces, names, and name-face pairs.

Self-regulatory elements in training

Although the strategies taught did not differ by training group, the training format varied according to whether the approach was designed to enhance self-regulation. That is, the SB strategy lessons and workbook included elements to enhance self-regulation, maintaining the EMC-style approach. To the extent possible, these training elements were absent for the SO training group, to determine the precise benefit from a training focus on enhancing self-regulation (Aim 2). Some elements, such as social

support provided by peers, may occur naturally in group training; the instructor emphasized these features for the SB group, but not the SO group.

The target elements used to enhance self-regulation were based on Bandura's self-efficacy theory; they target four influential sources of self-efficacy: enactive mastery, vicarious experience, verbal persuasion, and physiologic and affective states (Bandura, 1997; Smith & West, 2006). The purpose of the SB training was presented as one focused on personal improvement, rather than getting 100% correct (reduces anxiety when individuals have personal control over the effort required), and practice exercises in the SB version of the workbook were in order of increasing challenge with simpler exercises first (to gain mastery before trying more difficult tasks). SB trainees received positive feedback on use of the trained strategies as observed by the instructor in class (verbal persuasion with respect to one's potential for memory change) and heard reframing of negative comments from the instructor (anxiety reduction). Throughout the SB program, instructors emphasized that memory change is possible at any age.

In contrast, the SO training condition did not emphasize any self-regulatory elements: the focus of the training was presented as obtaining high performance, practice exercises were presented in random order, and instructors ignored rather than reframed negative comments. Instructors did not provide positive feedback, nor did they emphasize the potential for growth at any age. A complete listing of the elements to enhance self-regulation included in each condition is detailed in Table 5-3, and specific examples of these elements in the training materials are reproduced in Table 5-4.

Expert raters coded the written training materials for elements that might enhance or diminish self-efficacy. Written materials that varied between the SO and SB

training groups were coded. These materials included a transcription of the training session, instructions, and assigned readings. Expert coders tallied incidences of specific categories of elements that should enhance self-efficacy, such as anecdotes or personal stories of memory success, mention of research evidence and that training can be effective, and emphasis on individual differences in ability and that individuals are in control over their own strategy use (see Table 5-3). Absolute agreement amongst the five expert raters who coded all written training materials (i.e., instructions, assigned readings that differed between SB and SO conditions, transcript of the training sessions) was high; the intraclass correlation coefficient for their ratings was 0.95. The SB written training materials (M = 140.40, SD = 14.15) had significantly more incidences of the elements to enhance self-efficacy across all rated categories than the SO written training materials (M = 95.20, SD = 9.65), $t(4) = 12.77$, $p < .001$. Paired samples t-tests also suggested that the SB version of the materials had a greater number of each of the different types of elements to enhance self-efficacy, as compared to the SO version of the materials.

Table 5-1. Week-by-week overview of assessment and training procedure

Week	Groups	Agenda	SR
0	All	Phone interview: Eligibility, demographics, and other control measures	n/a
1	All	Pretest assessment: Primary and transfer outcomes	n/a
2	SB	2-hour group training session, followed by ~ 2 hours of self-study in workbook	✓
	SO	2-hour group training session, followed by ~ 2 hours of self-study in workbook	*
	Control	No meeting, homework, or other activity	×
3	All	Posttest assessment: Primary and transfer outcomes	n/a

*These groups may have included some self-regulatory elements, just because of their social nature, but no self-regulatory elements were supported or emphasized by the instructor or the materials.
Note: SR = Inclusion of elements to enhance self-regulation. “All” includes waitlist control.

Table 5-2. Overview of measures with references

Measure	Source
Phone Interview	
Verbal Informed Consent	
Telephone Interview for Cognitive Status (TICS)	Brandt et al., 1988
Rey Auditory-Verbal Learning Test (RAVLT)	Lachman et al., 2014; Lezak, 1995
Backward Digit Span from WAIS-III	Lachman et al., 2014; Wechsler, 1997
Short Form Health Survey (SF-12)	Ware et al., 1996; Ware et al., 1998
Perceived Mastery	Lachman & Weaver, 1998
General Memory Evaluation (GME)	West et al., 2009
Surveys of medication/supplement use, ratings of sensory function, demographic information	
Pretest/Posttest Assessments	
Written Informed Consent*	
Name Recall (Levels 1 and 2)	West et al., 2008
Memory Self-Efficacy Questionnaire (MSEQ-4)	West et al., 2003
Locus of Control for Memory (Metamemory in Adulthood Questionnaire subscale)	Dixon et al., 1998
Occupation-name Verbal Association	Craigie & Hanley, 1997; James, 2004
Object-Location Visual Association	Welch, 1998; West et al., 2002
Strategy Use Checklists (for name recall, occupation-name association, and object-location association)	West et al., 2008
Memory Anxiety (Metamemory in Adulthood Questionnaire subscale)	Dixon et al., 1998
Mindful Attention Awareness Scale (MAAS)	Brown & Ryan, 2003
Subjective Age Identity	Kastenbaum et al., 1972; Strickland-Hughes et al., 2016
Surveys of health and memory engagement	Created for the present research

* Pretest only

Table 5-3. List of training elements to enhance self-regulation included in each condition

Self-efficacy elements	Control	SO	SB
Enactive mastery			
Each skill practiced repeatedly	-	✓	✓
In class success remembering names of class members *	-	✓	✓
Success with strategy practice	-	✓	✓
Easier strategies first	-	-	✓
Self-set goals for practice and achievement	-	-	✓
Vicarious experience			
Trainer gives examples, models each strategy	-	✓	✓
Emphasis on learning from each other in class	-	-	✓
Encourage personal stories provided by group members	-	-	✓
Whole group practices strategy together	-	✓	✓
Verbal persuasion			
Group provides social support *	-	✓	✓
Emphasize what "you already know"	-	-	✓
Positive feedback from trainer in session	-	-	✓
Readings emphasize potential at any age	-	-	✓
Research presented on strategy effectiveness and learning potential of seniors	-	-	✓
Trainer reframes all negative comments to emphasize potential	-	-	✓
Physiologic and affective states (reducing anxiety)			
At home training materials to allow self-pacing or sufficient time for learning	-	✓	✓
Readings reviewed in class to help trainees understand	-	✓	✓
Class discussion shows that others have similar problems*	-	-	✓
Emphasis on process/learning, not on 100% score	-	-	✓
Focus on potential in readings and in class sessions	-	-	✓
Self-set goals, emphasize personal decision-making about what to learn	-	-	✓
Trainer emphasizes that everyone has memory failures	-	-	✓

* While this element may occur naturally in group training, trainer will emphasize or encourage this in SB condition, but not in the SO condition.

Table 5-4. Examples of self-regulatory elements in training materials

SB Version	SO Version
1. Workbook Introductory Paragraph	1. Workbook Introductory Paragraph
We recognize that each person begins on a different level. We all start with different skills and different ability levels. Each person has different memory experiences. By beginning with fairly simple techniques, we hope to ensure that all of you understand and benefit from this lesson, even if you have very little background in memory. The Everyday Memory Training program is not about being an expert memorizer. It's not about getting 100%. It's about each one of you learning and improving, so that you will be able to remember more after the program is done.	Memory is complicated. We have been working on memory research for many years. So we are going to try to teach you specific techniques that might help you to improve your memory performance. Because there are many different techniques, you will learn more than one technique in class. Some of these techniques will be hard and other memory methods will be easy. And you will be asked to do practice exercises with these techniques. The lesson in class today and the readings and practice exercises are intended to help you to raise your memory scores.
2. Workbook Closing Paragraph	2. Workbook Closing Paragraph
In this memory training program, you have learned how to use different memory techniques. We have discussed association, imagery, the image-name-match method and active observation. Research evidence tells us that each of these techniques can support your memory in general and make it more likely that you will remember names. The homework section of this notebook starts on the next page. The homework includes readings and memory activities that will give you an opportunity to practice and master the memory techniques that you learned today.	In this memory training program, you have learned how to use different memory techniques. We have discussed association, imagery, the image-name-match method and active observation. Each of these techniques can support your memory in general and make it possible to remember names. The homework section of this notebook starts on the next page. The homework includes readings and memory activities that will improve your memory scores.
3. Excerpt from General Instructions for Practice Exercises	3. Excerpt from General Instructions for Practice Exercises
You have an activity log with this packet so that you can keep track of your exercise time. The more you practice, the better you will do on these tasks. It is up to you. With additional practice, you are more likely to master the strategies you learned in class.	You have an activity log with this packet so that you can keep track of your exercise time. The more you practice, the better you will do on these tasks.

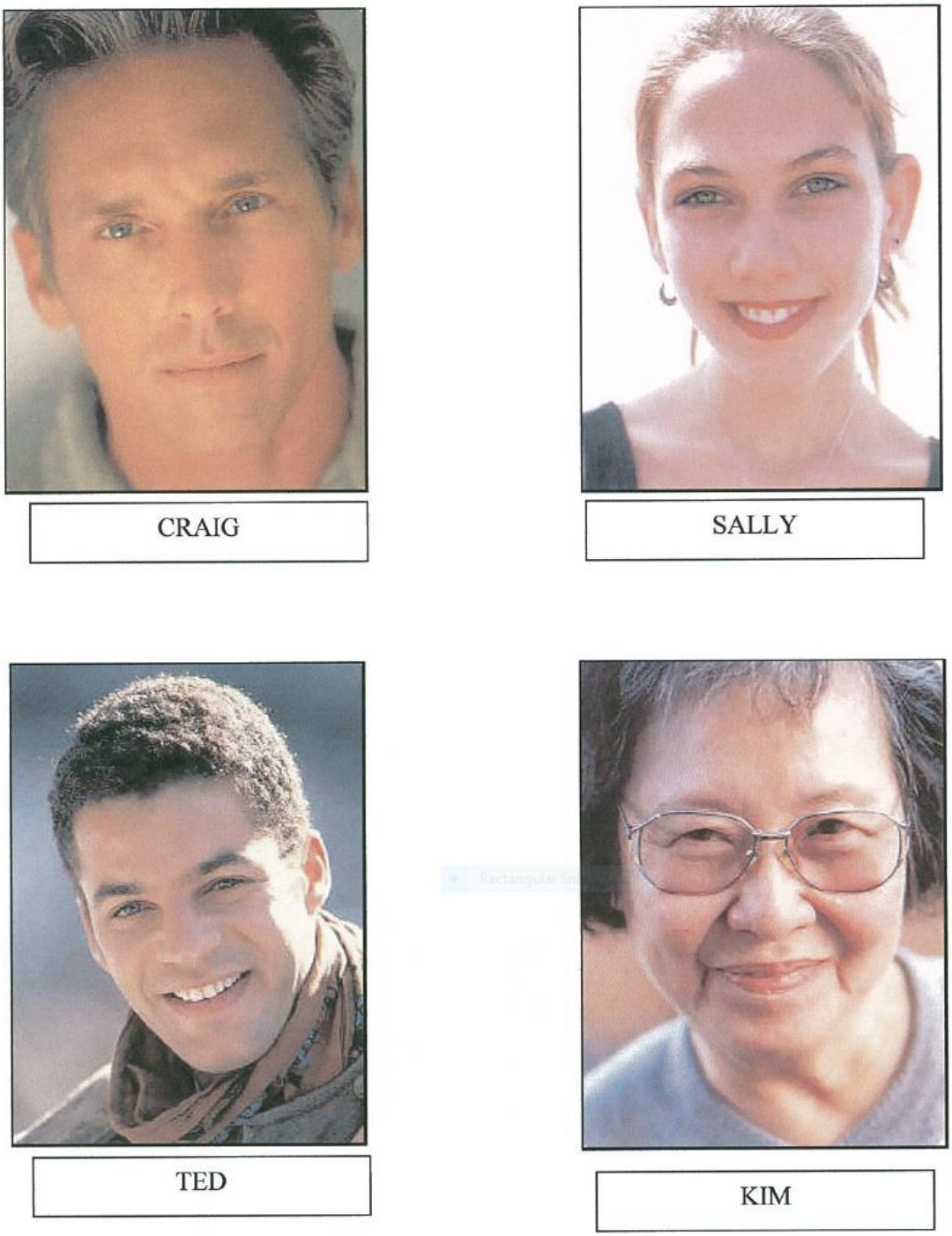


Figure 5-1. Example page of to-be-remembered name-face pairs used in the name recall task

CHAPTER 6
RESULTS

The research design employed a 2 (time: pretest, posttest) × 3 (condition: CT, SO, SB) mixed-model design that allowed for examination of research aims via separate repeated measures analyses of variance (ANOVAs) and chi-square tests. Primary outcomes were continuous variables (name recall performance, memory self-efficacy, personal locus of control for memory, number of strategies used) and one categorical variable (use of most effective strategy). All transfer outcomes were continuous variables (object-location recall, occupation-name immediate recall, occupation-name delayed recall, occupation-name delayed recognition). Reported effect sizes are partial eta-squared (η^2) values from SPSS version 24 (IBM Corp., 2016).

Preliminary Results: Baseline Data by Condition

Preliminary univariate ANOVAs were conducted to ensure that the three training groups were comparable at baseline. At baseline, the training groups did not differ in years of education, subjective ratings of English language ability (overall speaking, writing, and comprehension), vision, or hearing, performance on tests of episodic and working memory (RAVLT immediate and delayed recall; backward digit span), self-reported physical health and mental health, perceived mastery (global control), or General Memory Evaluation (global memory self-efficacy). Means and standard deviations by training condition appear in Table 6-1. Pearson's χ^2 tests confirmed that random assignment to training condition was independent from whether participants self-identified as female or white, *p*s > .05.

Although the SB condition appeared relatively disadvantaged across several baseline measures (e.g., fewer years of education, worse self-reported physical health),

the only significant condition difference was for age at pretest, $F(2,121) = 3.50$, $p = .033$. Follow-up pairwise comparisons confirmed that the SB participants were older than the SO participants ($M_{diff} = 4.57$, $SE = 1.78$, $p = .035$) but not the CT participants ($M_{diff} = 3.56$, $SE = 1.87$, $p = .176$), and the SO and CT participants did not differ in age ($M_{diff} = 1.01$, $SE = 1.78$, $p = 1.00$). To address this condition difference for participant age, all analyses were conducted with and without age included as a covariate. Because the pattern of results was the same, the analyses are reported without age as a covariate.

Aim 1 Results: Effectiveness of Abbreviated Training Dosage

The first aim of the present research was to test whether brief strategy training for name recall is effective. Training effectiveness was operationalized as greater improvement for trained participants, compared to the waitlist control group, for the primary outcomes. Separate 2 time (within: pretest, posttest) × 2 condition (between: control, trained) repeated measures ANOVAs were conducted for each of the continuous primary outcomes (name recall, memory self-efficacy, memory control, number of strategies used). Means and standard deviations are reported in Table 6-2.

Considering the unbalanced design of these analyses, Pillai's Trace *F*-approximations are reported for all repeated measures ANOVAs with a significant Box's M test of homogeneity of covariance ($p < .001$). All pairwise *post hoc* comparisons were conducted with Bonferroni-corrected analyses, and *p*-values are reported where significant. Alpha level of 0.05 was used as the significance criteria. A Pearson's χ^2 test was conducted for the categorical primary outcome variable (whether most effective strategy was used).

Training Effects for Name Recall Performance

Level 2 name recall performance was examined because this more difficult level of the test was expected to benefit from training, due to its nested design. As expected (*Hypothesis 1a*), the main effect of time was significant, $F(1,115) = 3.61$, $p = .060$, $\eta^2 = .03$. Name recall performance at posttest was greater than performance at pretest across both trainees and control participants. Qualifying this main effect, the interaction between time and condition was significant, $F(1,115) = 4.32$, $p = .040$, $\eta^2 = .04$. Post hoc pairwise comparisons indicated that performance between trainees and control participants did not differ at pretest ($M_{diff} = -0.85$, $SE = 4.83$, $p = .861$) or at posttest ($M_{diff} = 6.81$, $SE = 4.77$, $p = .156$). However, confirming *Hypothesis 1b*, trainees performed better at posttest than they did at pretest ($M_{diff} = 7.33$, $SE = 2.10$, $p < .001$), whereas control participants did not ($M_{diff} = -0.33$, $SE = 3.03$, $p = .914$). The interaction effect is depicted in Figure 6-1.

Training Effects for Memory Self-Efficacy

For memory self-efficacy, the main effect of time was unexpectedly significant, $F(1,115) = 27.62$, $p < .001$, $\eta^2 = .19$. Memory self-efficacy was greater at posttest than at pretest across both trainees and control participants ($M_{diff} = 5.81$, $SE = 1.12$, $p < .001$). This main effect was qualified by a significant interaction between time and condition, $F(1,115) = 7.51$, $p = .007$, $\eta^2 = .06$, consistent with *Hypothesis 1c*. Post hoc pairwise comparisons indicated that memory self-efficacy between trainees and control participants did not differ at pretest ($M_{diff} = -3.85$, $SE = 3.31$, $p = .391$) or at posttest ($M_{diff} = 3.31$, $SE = 3.24$, $p = .310$). However, trainees reported greater memory self-efficacy at posttest than they did at pretest ($M_{diff} = 8.99$, $SE = 1.28$, $p < .001$), whereas control

participants, who were expected to report declined pretest to posttest memory self-efficacy, reported no change (M_{diff} = 2.83, *SE* = 1.85, *p* = .129), as shown in Figure 6-2.

Training Effects for Memory Control Beliefs

A 2 time (within: pretest, posttest) × 2 condition (between: control, trained) repeated measures ANOVA was conducted for memory control beliefs. Unexpectedly, the main effect of time was significant, $F(1,115) = 7.10$, $p = .009$, $\eta^2 = .06$. Memory control beliefs were higher at posttest than at pretest across both trainees and control participants (M_{diff} = 0.11, *SE* = 0.04, *p* = .009). The interaction between time and condition was not significant, $F(1,115) = 2.29$, $p = .133$, $\eta^2 = .02$. Post hoc pairwise comparisons indicated that memory control beliefs did not differ between trainees and control participants at pretest (M_{diff} = 0.03, *SE* = 0.10, *p* = .773) or at posttest (M_{diff} = .15, *SE* = 0.10, *p* = .131). As expected (*Hypothesis 1d*), control participants reported no pre-post change in memory control beliefs due to repeated testing (M_{diff} = .05, *SE* = 0.07, *p* = .485). However, trainees reported pre-post gains in memory control beliefs (M_{diff} = .17, *SE* = 0.05, *p* < .001).

Training Effects for Strategy Use

Number of strategies used

A 2 time (within: pretest, posttest) × 2 condition (between: control, trained) repeated measures ANOVA was conducted for number of name recall strategies used. Consistent with expectations (*Hypothesis 1e*), the main effect of time was significant, $F(1,115) = 26.72$, $p < .001$, $\eta^2 = .19$. Both trainees and control participants used a greater number of name recall strategies at posttest than pretest (M_{diff} = 5.76, *SE* = 1.11, *p* < .001). Further, the interaction between time and condition was significant, $F(1,115) = 5.70$, $p = .019$, $\eta^2 = .05$. Post hoc pairwise comparisons indicated that

strategy use did not differ between trainees and control participants at pretest (M_{diff} = -0.64, *SE* = 1.98, *p* = .746). However, trainees used a greater number of strategies than control participants at posttest (M_{diff} = 4.67, *SE* = 2.33, *p* = .047), confirming *Hypothesis 1f*. Control participants reported no pre-post change in strategy use (M_{diff} = 3.10, *SE* = 1.83, *p* = .093), but trainees reported pre-post gains in strategy use (M_{diff} = 8.41, *SE* = 1.27, *p* < .001). The significant interaction is depicted in Figure 6-3.

Effective strategy use

Effective strategies were operationalized as name recall strategies that were associated with superior name recall performance. Independent samples t-tests were conducted to test whether mean name recall performance (percent correct at Level 2) varied as a function of using a particular strategy (the complete strategy checklist is included in Appendix A). The two-tailed significance levels of α = .05 were used, although a priori expectations were directional (use of a given strategy was expected to be related to better performance than not using the strategy). Chi-square tests were also used to examine whether use of the most effective strategies as one of the one or two most frequently used strategies (that is, as the *preferred strategy*) varied between trainees and the control group. Tests were conducted separately for pretest and posttest data.

Identification of effective strategies. One strategy was identified as effective at both pretest and posttest. That most effective strategy was *I associated the name with the name of someone else I know* (i.e., *familiar name* strategy). Participants who reported using the familiar name strategy, compared to those who did not, performed better on the Level 2 name recall test at pretest (47.93% used; M_{diff} = 14.91, *SE* = 4.27),

$t(119) = 3.49$, $p < .001$, and at posttest (54.24% used; $M_{diff} = 16.45$, $SE = 4.21$), $t(116) = 3.90$, $p < .001$.

Another strategy seemed to be effective overall. Participants who reported using the strategy *I tried to think of a meaningful association for the name* (i.e., *associate name* strategy) performed better than those who did not at pretest (57.02% used; $M_{diff} = 10.76$, $SE = 4.41$), $t(119) = 2.44$, $p = .016$, and use of the associate name strategy was marginally related to better performance at posttest (65.25% used; $M_{diff} = 8.35$, $SE = 4.62$), $t(116) = 1.81$, $p = .073$. Thus, the second most effective strategy was use of a meaningful association for the name.

Two other strategies were effective at pretest or posttest, but not both testing occasions. Participants who reported using the strategy *I associated the face with the face of someone else I know* (i.e., *familiar face* strategy) performed comparably to those who did not at pretest (37.19% used; $M_{diff} = 5.15$, $SE = 4.61$), $t(119) = 1.12$, $p = .266$, yet had superior performance at posttest (50.00% used; $M_{diff} = 13.77$, $SE = 4.28$), $t(116) = 3.22$, $p = .002$. Participants who reported using the strategy *I covered the faces, looked away and tested myself on the names* (i.e., *self-test* strategy) performed better than those who did not at pretest (14.05% used; $M_{diff} = 17.74$, $SE = 6.24$), $t(119) = 2.84$, $p = .005$, but this benefit was not evidenced at posttest (28.82% used; $M_{diff} = 5.59$, $SE = 4.90$), $t(116) = 1.16$, $p = .248$.

The two strategies that were generally effective (familiar name and associate name), as well as the other strategy that was effective at posttest (familiar face), related to use of associations. Forming associations was a focus of the training class and represented a relatively simple strategic approach, compared to the more complex

strategies taught in class. Therefore, these three strategies were also examined together as a set of effective strategies. This definition of effective strategy use was more lenient than the other two because the familiar name and associate name strategies were included in this identified *effective strategy set*.

Examination of effective strategy use by training condition. Chi-square tests of independence were conducted to evaluate whether frequency of effective strategy use varied between trainees and control participants at pretest and posttest. Most effective strategy use was defined as preferred use of either (a) the effective familiar name strategy, (b) the effective associate name strategy, or (c) the set of three effective association strategies. Use of this tiered classification system permitted a nuanced examination of training effects for this self-regulatory factor.

At pretest, trainees and the control participants did not differ in their frequency of preferred use of the familiar name strategy, $X^2(1) = 0.32$, $p = .570$, of the associate name strategy, $X^2(1) = 0.09$, $p = .766$, or the effective association strategies, $X^2(1) = 1.36$, $p = .244$. Trainees and control participants also did not differ in their frequency of using the familiar name strategy as a preferred strategy at posttest, $X^2(1) = 0.14$, $p = .714$. This finding suggested that the training did not affect on whether participants relied on making associations between the names and the names of people whom they knew. However, this particular strategy was not emphasized during training.

A greater proportion of trainees, compared to control participants, reported preferred use of the associate name strategy at posttest, $X^2(1) = 4.88$, $p = .027$. The odds ratio suggested that the odds of preferred use of the associate name strategy at posttest were 2.80 times higher if participants received training than if they did not

receive training. Further, there was a significant association between training and preferred use of the set of effective association strategies at posttest, $X^2(1) = 5.08$, $p = .024$. Based on the odds ratio, the odds of participants preferring one of the effective association strategies at posttest were 2.48 times higher if they received training than if they did not receive training. These findings, showing greater use of association strategies by trainees, provide partial support for *Hypothesis 1g.* Results of the chi-square tests are summarized in Table 6-3.

Aim 2 Results: Impact of Beliefs-Focused Training

The second aim of the proposed research was to determine the precise value-added from training designed to enhance self-regulation (strategy-plus-beliefs; SB), as opposed to a traditional, strategy-only approach (strategy-only; SO). Repeated measures analyses were used to compare training effectiveness (i.e., greater improvements for the primary outcomes) between the two training approaches. Separate 2 time (within: pretest, posttest) $\times$ 2 condition (between: SO, SB) repeated measures ANOVAs were conducted for each of the continuous primary outcomes (name recall, memory self-efficacy, memory control, number of strategies used). All pairwise *post hoc* comparisons were conducted with Bonferroni-corrected analyses, and *p*-values are reported where significant. Alpha level of 0.05 was used as the significance criteria. Means and standard deviations are reported in Table 6-4. A Pearson's χ^2 test was conducted for the categorical primary outcome variable (whether most effective strategy was used).

Beliefs-Focused Training Effects for Name Recall

As expected (*Hypothesis 2a*), the main effect of time on Level 2 name recall performance was significant, $F(1,77) = 12.74$, $p = .001$, $\eta^2 = .14$. Across both training

conditions, trainees demonstrated improvement at posttest, compared to their pretest performance (M_{diff} = 7.37, *SE* = 2.07, *p* = .001). Although a significant interaction effect was expected (*Hypothesis 2b*), results suggested that the pre-post improvement in name recall performance was not greater for SB trainees than for SO trainees, $F(1,77)$ = 0.03, *p* = .860, $\eta^2 < .001$. Name recall performance did not differ between SB and SO trainees at pretest (M_{diff} = -8.28, *SE* = 5.70, *p* = .150) or at posttest (M_{diff} = -7.55, *SE* = 5.53, *p* = .176). Performance improved at posttest, compared to pretest, for both SB trainees (M_{diff} = 7.74, *SE* = 3.08, *p* = .014) and SO trainees (M_{diff} = 7.01, *SE* = 2.75, *p* = .013).

Beliefs-Focused Training Effects for Memory Self-Efficacy

For memory self-efficacy strength, the main effect of time was significant, $F(1,77)$ = 50.15, $p < .001$, η^2 = .39, and the interaction between time and condition was not, $F(1,77)$ = 1.04, *p* = .310, η^2 = .01. Memory self-efficacy strength was greater at posttest than pretest (M_{diff} = 8.84., *SE* = 1.25, $p < .001$) across both SO and SB trainees. SB trainees reported levels of memory self-efficacy strength that were similar to SO trainees at pretest (M_{diff} = -2.45, *SE* = 3.85, *p* = .526) and at posttest (M_{diff} = -5.00, *SE* = 3.74, *p* = .184). Further, memory self-efficacy strength was higher at posttest than pretest for both SB trainees, (M_{diff} = 7.57, *SE* = 1.86, $p < .001$) and SO trainees (M_{diff} = 10.12, *SE* = 1.66, $p < .001$). Consistent with expectations (*Hypothesis 2c*), the SB trainees reported pre-post increases in memory self-efficacy strength, but, contrary to expectations, SO trainees also reported increased, rather than maintained, memory self-efficacy strength.

Beliefs-Focused Training Effects for Memory Control

A 2 (time: pretest, posttest) × 2 (condition: SO, SB) repeated measures ANOVA with personal control beliefs for memory as the dependent variable was conducted to test *Hypothesis 2d*. The main effect of time was significant, $F(1,77) = 15.12$, $p < .001$, $\eta^2 = .16$, but the interaction between time and condition was not, $F(1,77) = 1.18$, $p = .280$, $\eta^2 = .02$. Memory control beliefs were greater at posttest than pretest ($M_{diff} = 0.18$, $SE = 0.05$, $p < .001$) across both SO and SB trainees. SB trainees reported levels of memory control beliefs that were similar to SO trainees at pretest ($M_{diff} = -1.29$, $SE = 0.11$, $p = .262$) and at posttest ($M_{diff} = -0.03$, $SE = 0.12$, $p = .798$). Consistent with expectations (*Hypothesis 2d*), memory control was higher at posttest than pretest for SB trainees ($M_{diiff} = 0.22$, $SE = 0.07$, $p = .001$). Memory control was also higher at posttest than pretest for SO trainees ($M_{diiff} = 0.13$, $SE = 0.06$, $p = .039$).

Beliefs-Focused Training Effects for Strategy Use

Number of strategies used

A 2 time (within: pretest, posttest) × 2 condition (between: SO, SB) repeated measures ANOVA was conducted for number of name recall strategies used. The main effect of time was significant, $F(1,77) = 39.26$, $p < .001$, $\eta^2 = .34$. A greater number of name recall strategies were used at posttest than pretest across all trainees ($M_{diiff} = 8.24$, $SE = 1.31$, $p < .001$), as expected (*Hypothesis 2e*). However, the interaction between time and condition was not significant, $F(1,77) = 1.33$, $p = .252$, $\eta^2 = .02$, contrary to expectations (*Hypothesis 2f*). Number of strategies used was similar for SB and SO trainees at pretest ($M_{diiff} = 1.96$, $SE = 2.24$, $p = .384$) and at posttest ($M_{diiff} = 1.08$, $SE = 2.63$, $p = .683$), and strategy use increased from pretest to posttest for both

SB trainees (M_{diiff} = 6.72, SE = 1.96, p = .001), and SO trainees (M_{diiff} = 9.76, SE = 1.75, p < .001).

Effective strategy use

As described in the Aim 1 Results section, effective strategies were defined as those related to superior name recall performance. The most effective strategy was familiar name, the second most effective strategy was associate name, and a set of three effective association strategies was also identified. Chi-square tests of independence were conducted to evaluate whether frequency of effective strategy use varied between SB and SO trainees at pretest and posttest. These results showed no differences between SB and SO trainees, as summarized in Table 6-5, and provided no support for *Hypothesis 2g*.

Aim 3 Results: Near Transfer Effects

The third aim of the proposed research was to determine whether the beliefs-focused training program would promote near transfer, as evidenced by pre-post performance gains on transfer tasks, or untrained associative memory tasks. Given the limited reports of near transfer effects reported for past memory training programs, four different transfer tasks were administered to permit a broad and nuanced examination of whether any near transfer might occur. The transfer tasks were object-location recall (OBJ), occupation-name immediate recall (ON Imd), occupation-name delayed recall (ON Delay), and occupation-name delayed recognition (ON Recog). Preliminary analyses were conducted to evaluate the correlations between the transfer tasks and to compare their difficulty. Hypotheses 3a – 3d were tested with separate repeated measures 2 time (within: pretest, posttest) × 3 condition (between: CT, SO, SB) ANOVAs that compared performance on the four transfer tasks to determine whether

the beliefs-focused training program promoted near transfer, compared to the other groups. All pairwise *post hoc* comparisons were conducted with Bonferroni-corrected analyses, and *p*-values are reported where significant. Alpha level of 0.05 was used as the significance criteria. Means and standard deviations are reported in Table 6-6.

Preliminary Analyses for Transfer Outcomes

The four transfer outcomes were expected to be related to each other and to the targeted name recall task, but to represent distinct memory performance variables. Bivariate correlations between each of the transfer outcomes at pretest and at posttest were calculated to assess the magnitude and direction of the relationships between these variables and with the targeted face-name association task. Pearson's *r* correlation coefficients are reported in Table 6-7. All correlation coefficients were significant ($p < .001$).

Relationships among the transfer outcomes ranged from $r = .34$ to $r = .97$, with the weakest relationships between the object-location test and the occupation-name tests and the strongest relationships between the immediate and delayed occupation-name recall tests. Performance on the occupation-name recall, occupation-name recognition, and object-location recall tasks seemed to be distinct.

Relationships between level 2 name recall performance and the transfer outcomes ranged from $r = .46$ to $r = .62$. At pretest and at posttest, the magnitude of the relationships between name recall and the occupation-name immediate and delayed recall tasks were greater than those of the name recall task with the occupation-name delayed recognition task or the object-location delayed recall task. These findings suggest that the transfer tasks overall were sufficiently unrelated to the name recall task, and that training-related improvements on the occupation-name recall tasks might

represent more proximal transfer than improvements on the occupation-name delayed recognition task or the object-location recall task.

A within-subjects ANOVA was conducted to compare mean performance for all participants on the four transfer outcomes (test type: OBJ, ON Imd, ON Delay, ON Recog) at pretest to assess the relative difficulty-level of these associative memory tasks. The effect of test type was significant, $F(3,357) = 230.22$, $p < .011$, $\eta^2 = .66$. Pairwise comparisons indicated that performance on each of the transfer outcomes differed from performance on the others at pretest, all *p*s < .001, suggesting that these tasks varied in difficulty. The measures varied in difficulty following the expected pattern: by order of performance from low to high, tasks were occupation-name delayed recall, occupation-name immediate recall, occupation-delayed recognition, and object-location delayed recall, suggesting that the visual object-location task was easier than the verbal occupation-name task overall. For the occupation-name task, recall was more challenging than recognition, and recall was more challenging after a delay that allowed for additional interference. Mean scores and 95% confidence intervals are illustrated in Figure 6-4.

Near Transfer Effect for Object-Location Recall

Near transfer to object-location recall was tested with a 2 time (within: pretest, posttest) × 3 condition (between: CT, SO, SB) repeated measures ANOVA. Neither the main effect of time, $F(1,109) = 0.05$, $p = .826$, $\eta^2 < .001$, nor the interaction between test and condition, $F(2,109) = 0.57$, $p = .565$, $\eta^2 = .01$, were significant. Performance on the object-location delayed recall test did not differ across the three conditions at pretest or at posttest, and posttest performance did not differ from pretest performance for any

of the three conditions, all *p*s > .05. Contrary to *Hypothesis 3a*, no support for transfer to performance on the object-location recall task was evidenced. Performance on this task did not improve as a function of training or repeated testing.

Near Transfer Effect for Occupation-Name Delayed Recognition

Near transfer to occupation-name delayed recognition was tested with a 2 time (within: pretest, posttest) × 3 condition (between: CT, SO, SB) repeated measures ANOVA. The main effect of time was significant, $F(1,115) = 18.89$, $p < .001$, $\eta^2 = .14$. Overall, mean performance was greater at posttest than at pretest ($M_{diiff} = 7.46$, $SE = 1.71$, $p < .001$). *Hypothesis 3b* was not supported as the interaction between time and condition was not significant, $F(2,115) = 2.22$, $p = .113$, $\eta^2 = .04$. Pairwise comparisons suggested that occupation-name delayed recognition performance did not vary by condition at pretest or at posttest, all *p*s > .05, although the SB trainees trended towards worse performance at pretest than both the SO trainees ($M_{diiff} = -12.79$, $SE = 5.44$, $p = .061$) and the control group ($M_{diiff} = -12.21$, $SE = 5.63$, $p = .097$). A follow-up univariate ANOVA comparing occupation-name recognition performance at pretest across the three training conditions was significant, $F(2,119) = 4.46$, $p = .014$, $\eta^2 = 07$. SB trainees performed worse than both SO trainees and the control group at pretest, suggesting baseline differences in the training conditions may have limited their capacity to demonstrate near transfer effects. However, pairwise comparisons that followed the repeated measures ANOVA, showed that posttest occupation-name recognition performance for SB trainees was improved at posttest, compared to pretest ($M_{diiff} = 12.59$, $SE = 3.10$, $p < .001$) and the same was true for SO trainees ($M_{diiff} = 5.83$, $SE = 2.80$, $p = .039$), but not for the control group ($M_{diiff} = 3.95$, $SE = 3.01$, $p = .193$). These

results suggest that some transfer occurred, but not just for the SB trainees as expected.

Near Transfer Effect for Occupation-Name Immediate Recall

Near transfer to occupation-name immediate recall was tested with a 2 time (within: pretest, posttest) × 3 condition (between: CT, SO, SB) repeated measures ANOVA. The main effect of time was significant, $F(1,115) = 15.95$, $p < .001$, $\eta^2 = .12$. Overall, mean performance was greater at posttest than at pretest ($M_{diiff} = 5.26$, $SE = 1.32$, $p < .001$). The interaction between time and condition was marginally significant, $F(2,115) = 2.57$, $p = .081$, $\eta^2 = .04$. Performance on the occupation-name immediate recall task did not differ across the three conditions at pretest or at posttest (all *p*s > .05), although SB trainees appeared to perform at a relative disadvantage at pretest. However, performance was better at posttest than pretest for both SB trainees ($M_{diiff} = 6.21$, $SE = 2.15$, $p = .005$) and SO trainees ($M_{diiff} = 8.43$, $SE = 2.38$, $p = .001$), whereas the control group demonstrated no pre-post change in performance ($M_{diiff} = 1.11$, $SE = 2.31$, $p = .623$). This result reflected transfer, but did not support *Hypothesis 3c,* which predicted transfer only for the SB group. Occupation-name immediate recall performance by condition at pretest and posttest is illustrated in Figure 6-5.

Near Transfer Effect for Occupation-Name Delayed Recall

Performance on the occupation-name immediate recall and delayed recall tasks were highly correlated, and the pattern of results for these two transfer outcomes was the same. Near transfer to occupation-name delayed recall was tested with a 2 time (within: pretest, posttest) × 3 condition (between: CT, SO, SB) repeated measures ANOVA. The main effect of time was significant, $F(1,115) = 20.85$, $p < .001$, $\eta^2 = .15$.

Overall, mean performance was greater at posttest than at pretest (M_{diiff} = 5.77, *SE* = 1.26, $p < .001$). The interaction between time and condition was marginally significant, $F(2,115) = 2.87$, $p = .061$, $\eta^2 = .05$. Performance on the occupation-name delayed recall task did not differ across the three conditions at pretest or at posttest (all *p*s > .05). The SB trainees again appeared to perform with relative disadvantage at pretest, but the difference was not significant. However, performance was better at posttest than pretest for both SB trainees (M_{diiff} = 9.54, *SE* = 2.28, $p < .001$) and SO trainees (M_{diiff} = 5.83, *SE* = 2.06, $p = .005$), whereas the control group demonstrated no pre-post change in performance (M_{diiff} = 1.91, *SE* = 2.22, $p = .386$), reflecting transfer for both trainee groups (lack of support for *Hypothesis 3d*). Occupation-name delayed recall performance by condition at pretest and posttest is illustrated in Figure 6-6.

Table 6-1. Baseline statistics by training condition

	CT (*n* = 38) 78.9% female 94.7% white		SO (*n* = 46) 76.1% female 89.1% white		SB (*n* = 38) 81.6% female 92.1% white		Total (*N* = 122) 78.7% female 91.8% white	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age (years) [a]	72.51	8.34	71.51	7.34	76.08	8.83	73.24	8.31
Years of education	17.76	3.07	17.50	2.96	16.68	2.36	17.33	2.84
Rating of English ability (1 – 10)	9.32	0.93	8.91	1.31	9.03	0.97	9.07	1.11
Rating of corrected vision (1 – 10)	8.08	1.44	8.17	1.06	7.68	1.56	7.99	1.38
Rating of corrected hearing (1 – 10)	7.87	1.55	8.33	1.52	7.97	1.64	8.07	1.57
RAVLT immediate recall (0 – 15)	7.68	2.41	7.28	2.23	7.21	2.71	7.39	2.42
RAVLT delayed recall (0 – 15)	4.11	2.47	4.37	2.41	4.34	2.91	4.28	2.60
Backward digit span (2 – 8)	5.13	1.42	5.26	1.34	5.11	1.20	5.17	1.31
Physical health (PCS from SF-12)	50.25	8.79	49.05	10.14	47.81	8.99	49.04	9.36
Mental health (MCS from SF-12)	54.67	7.12	54.39	6.60	55.03	6.13	54.68	6.58
Perceived mastery (1 – 6)	5.19	0.65	5.00	0.77	4.99	0.91	5.06	0.78
General Memory Evaluation (1 - 7)	4.59	1.24	4.18	1.22	4.04	1.24	4.26	1.24

[a] Significant condition difference, $p < .05$.

CT = Waitlist control participants. SB = Strategy-plus-beliefs training group. SO = Strategy-only training group.

Table 6-2. Means and standard deviations for primary outcomes for trainees and control group at pretest and posttest

	Control (n = 38)		Trained (n = 79)		Total (N = 117)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Name recall (% correct)						
Pretest	47.37	22.52	46.52	25.34	46.79	24.37
Posttest	47.04	23.29	53.85	24.53	51.64	24.25
Memory self-efficacy (0 – 100)						
Pretest	41.96	16.45	39.11	16.95	40.03	16.77
Posttest	44.79	16.08	48.09	16.58	47.02	16.42
Memory control (1 – 5)						
Pretest	3.42	0.54	3.45	0.50	3.44	0.51
Posttest	3.47	0.47	3.62	0.52	3.57	0.51
Name recall strategy use (% used)						
Pretest	26.78	10.39	26.14	9.87	26.34	10.00
Posttest	29.88	12.26	34.55	11.55	33.03	11.94

Note. Values reported are actual means, not estimated means.

Table 6-3. Effective strategy use for trainees and control group at pretest and posttest

	Pretest			Posttest		
	Control (n = 38)	Trained (n = 83)	X^2 test	Control (n = 38)	Trained (n = 80)	X^2 test
Familiar name strategy (% preferred use)	28.95	24.10	$X^2(1) = 0.32$, $p = .570$	31.58	35.00	$X^2(1) = 0.14$, $p = .714$
Associate name strategy (% preferred use)	31.58	28.92	$X^2(1) = 0.09$, $p = .766$	18.42	38.75	$X^2(1) = 4.88$, $p = .027$
Effective association strategies (% preferred use)	63.16	51.81	$X^2(1) = 1.36$, $p = .244$	50.00	71.25	$X^2(1) = 5.08$, $p = .024$

Table 6-4. Means and standard deviations for primary outcomes for SO and SB trainees at pretest and posttest

	SO (*n* = 44)		SB (*n* = 35)		Total (*N* = 79)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Name recall (% correct)						
Pretest	50.19	25.59	41.90	24.61	46.52	25.34
Posttest	57.20	23.59	49.64	25.37	53.85	24.53
Memory self-efficacy (0 – 100)						
Pretest	40.19	16.85	37.74	17.22	39.11	16.95
Posttest	50.31	15.85	45.31	17.27	48.09	16.58
Memory control (1 – 5)						
Pretest	3.51	0.47	3.38	0.54	3.45	0.50
Posttest	3.63	0.56	3.60	0.49	3.62	0.52
Name recall strategy use (% used)						
Pretest	25.27	8.38	27.23	11.51	26.14	9.87
Posttest	35.03	10.98	33.95	12.36	34.55	11.55

Note. SB = Strategy-plus-beliefs training group. SO = Strategy-only training group. Values reported are actual means, not estimated means.

Table 6-5. Effective strategy use for SO and SB trainees at pretest and posttest

	Pretest			Posttest		
	SO (n = 46)	SB (n = 37)	X^2 test	SO (n = 44)	SB (n = 36)	X^2 test
Familiar name strategy (% preferred use)	23.91	24.32	$X^2(1) = 0.00$, $p = .965$	27.27	44.44	$X^2(1) = 2.57$ $p = .109$
Associate name strategy (% preferred use)	21.74	37.84	$X^2(1) = 2.59$, $p = .108$	43.18	33.33	$X^2(1) = 0.81$, $p = .368$
Effective association strategies (% preferred use)	54.35	48.65	$X^2(1) = 0.27$, $p = .606$	68.18	75.00	$X^2(1) = 0.45$, $p = .503$

Note. SB = Strategy-plus-beliefs training group. SO = Strategy-only training group.

Table 6-6. Means and standard deviations for transfer outcomes by training condition at pretest and posttest

	CT (n = 38)		SO (n = 44)		SB (n = 36)		Total (N = 118)	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Occupation-name immediate recall (%)								
Pretest	28.86	16.93	30.00	21.39	22.04	19.86	27.20	19.72
Posttest	30.00	19.25	36.21	20.84	30.46	22.14	32.46	20.78
Occupation-name delayed recall (%)								
Pretest	25.00	15.02	26.06	21.74	18.61	18.91	23.45	19.04
Posttest	26.93	17.85	31.89	20.99	28.15	22.29	29.15	20.40
Occupation-name delayed recognition (%)								
Pretest	53.51	22.15	54.09	24.45	41.30	25.98	50.00	24.71
Posttest	57.46	21.87	59.92	21.51	53.89	24.06	57.29	22.38
Object-location delayed recall (%)								
Pretest	62.99	20.36	66.70	24.34	56.55	24.39	62.40	23.40
Posttest	63.76	19.93	64.73	21.27	58.57	25.05	62.61	22.09

Note. CT = Waitlist control participants. SB = Strategy-plus-beliefs training group. SO = Strategy-only training group. Values are actual means, not estimated means.

Table 6-7. Correlations for pretest and posttest name recall and transfer outcomes

Measure	1	2	3	4	5
1. Name recall (level 2)	–	.60	.63	.51	.46
2. Occupation-name immediate recall	.60	–	.96	.74	.45
3. Occupation-name delayed recall	.62	.97	–	.75	.46
4. Occupation-name delayed recognition	.47	.71	.71	–	.52
5. Object-location delayed recall	.47	.41	.45	.34	–

Note. All coefficients are significant at $p < .001$. Intercorrelations for pretest are presented above the diagonal, and intercorrelations for posttest are presented below the diagonal. Each correlation was conducted using the maximum number of participants who had complete data for both measures (pretest n = 120 – 122; posttest n = 114 – 118).

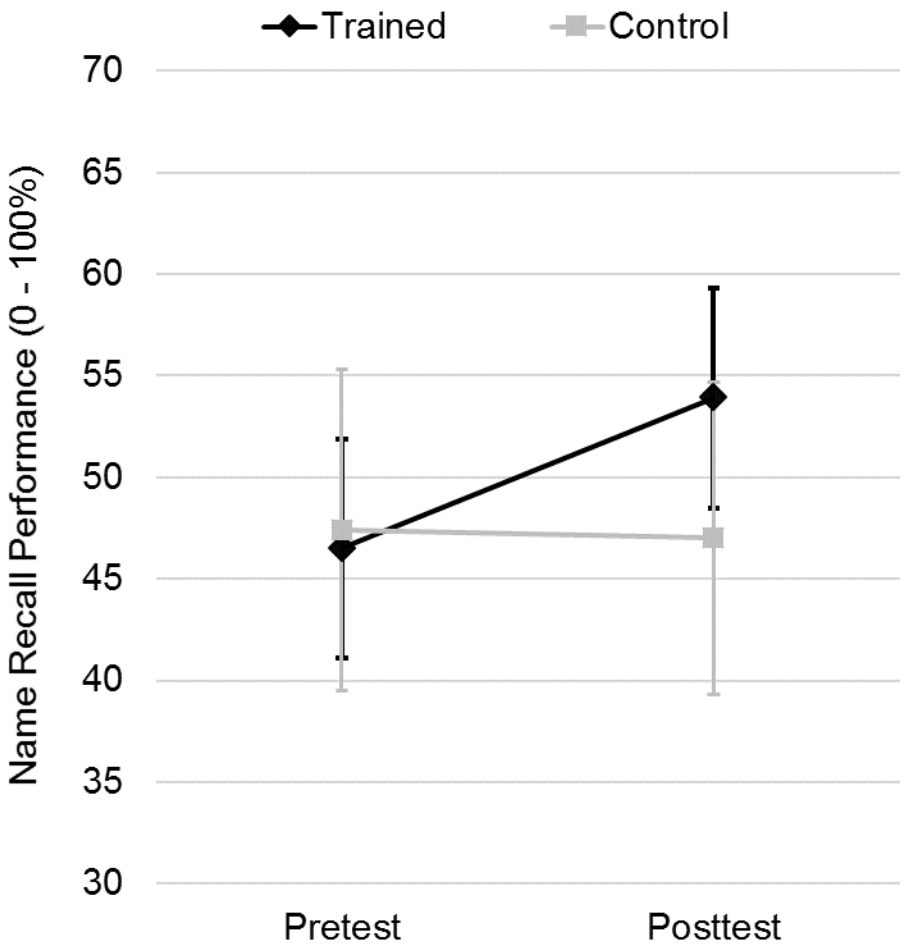


Figure 6-1. Name recall performance by time for trainees and control participants. Error bars represent 95% confidence intervals.

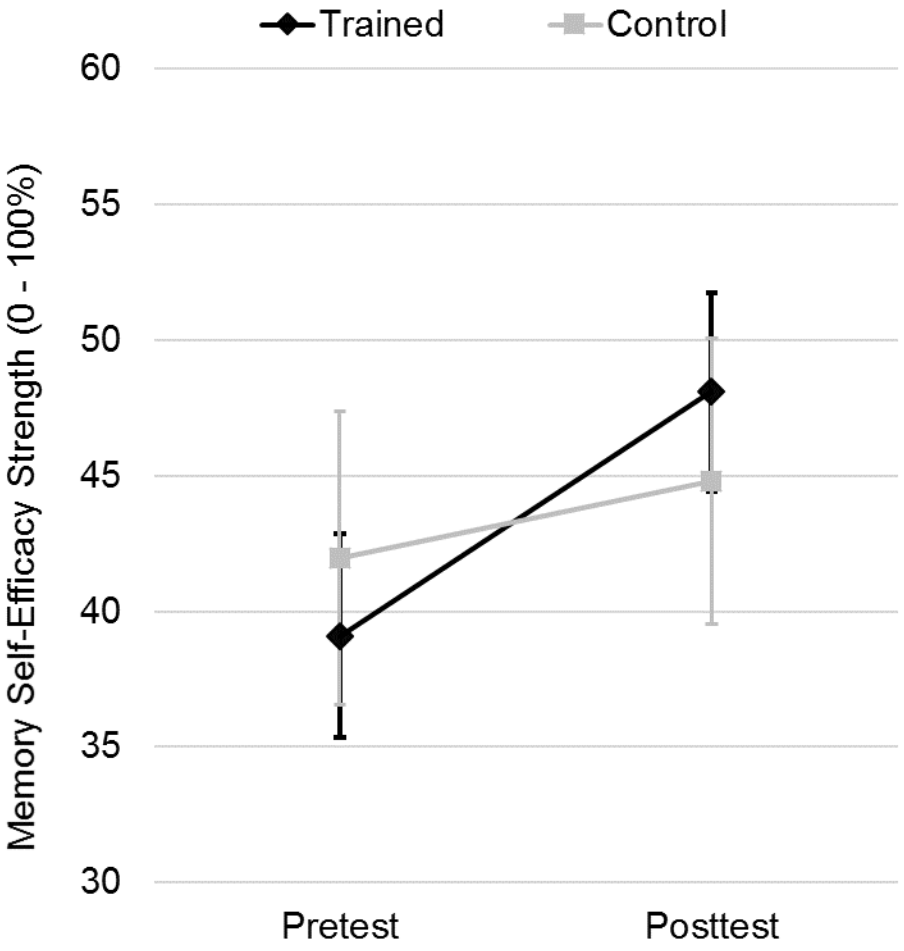


Figure 6-2. Memory self-efficacy by time for trainees and control participants. Error bars represent 95% confidence intervals.

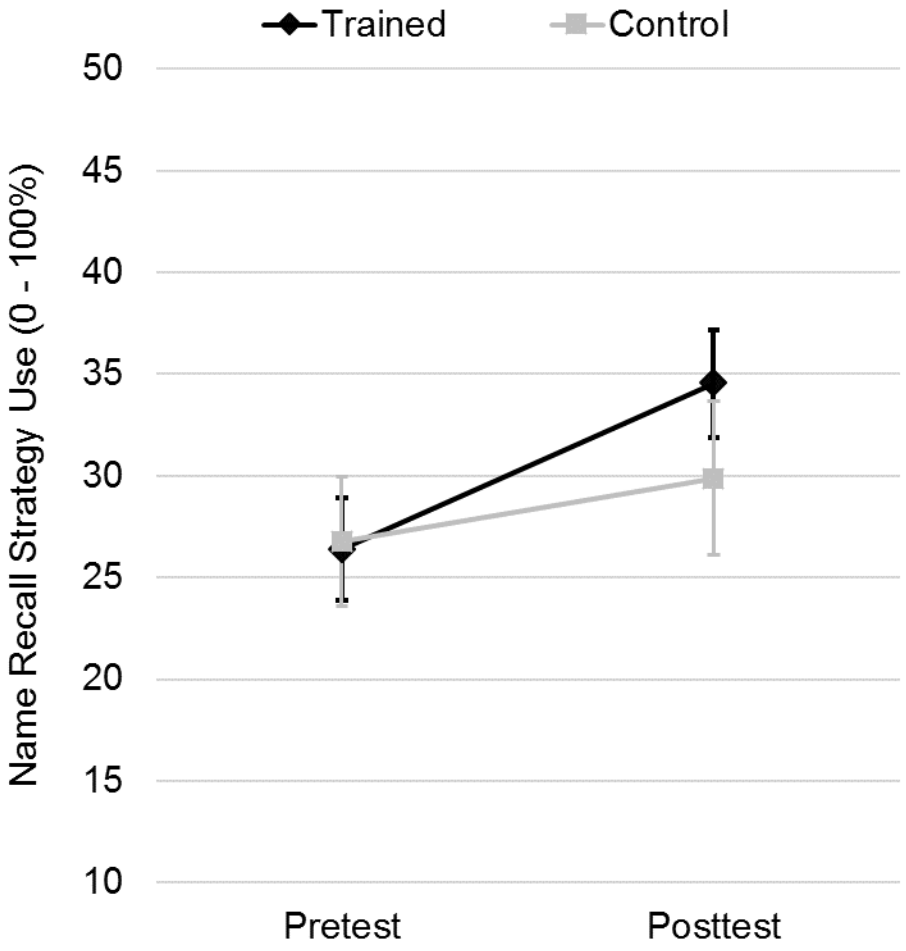


Figure 6-3. Name recall strategy use by time for trainees and control participants. Error bars represent 95% confidence intervals.

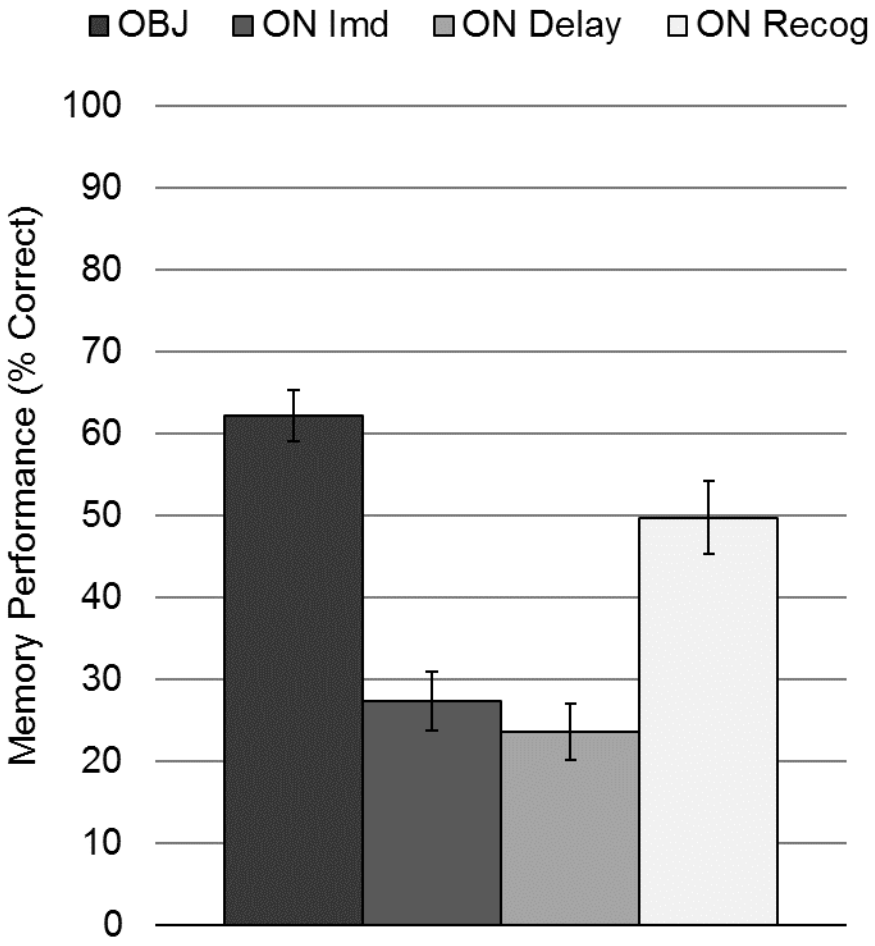


Figure 6-4. Memory performance (% correct) on transfer outcomes at pretest for all participants. Error bars represent 95% confidence intervals. OBJ = Object-location delayed recall. ON Delay = Occupation-name delayed recall. ON Imd = Occupation-name immediate recall. ON Recog = Occupation-name delayed recognition.

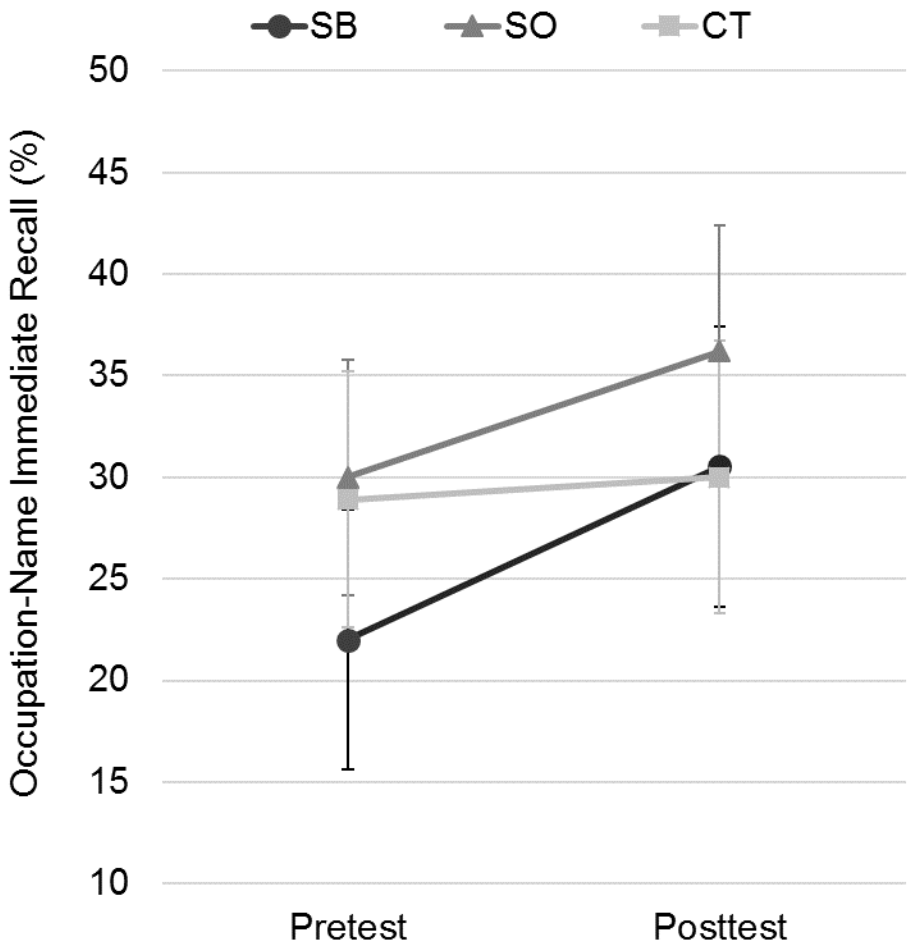


Figure 6-5. Occupation-name immediate recall performance by condition at pretest and posttest. Error bars represent 95% confidence intervals.

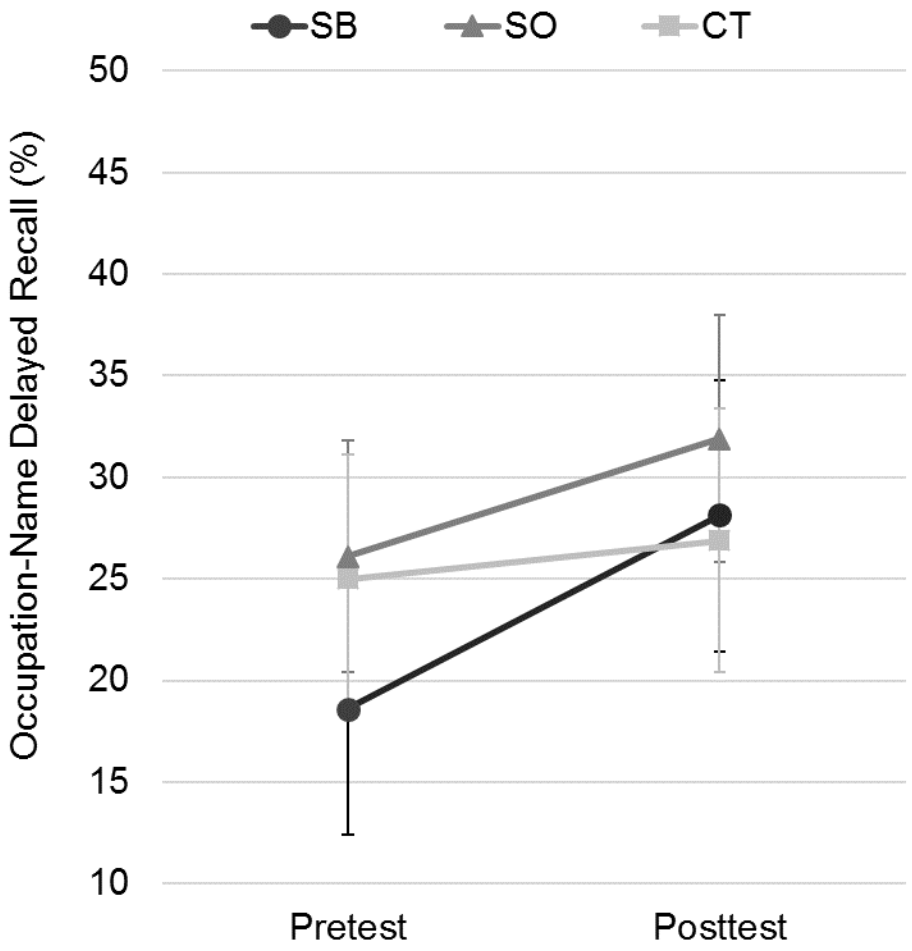


Figure 6-6. Occupation name delayed recall performance by condition at pretest and posttest. Error bars represent 95% confidence intervals.

CHAPTER 7
DISCUSSION

Everyday memory ability – such as learning and remembering names – is highly valued by people of all ages, yet is known to decline normatively with increasing age, when related non-ability self-regulatory factors, such as self-evaluative beliefs and metamemory, are also at increased risk. Collective results from cognitive interventions demonstrate that memory can be improved at any age, but controversy surrounds the true value of these programs in terms of the scope and duration of training-related gains. A traditional and common approach to cognitive interventions for adults is memory strategy training, and limited work of this type has examined whether self-regulatory factors might benefit from these programs or moderate other training-related gains. Further, while interventions focused on intensive practice or core capacity training have demonstrated near transfer – after training, performance improves on untrained tasks related to the target task – evidence of near transfer from strategy training programs is very rare.

The present research addressed both self-regulation and transfer issues. Could a short-term training program, focused on strategy training, lead to changes in beliefs and strategy usage, as well as score gains? Would a short program emphasizing self-regulatory change be more effective than a program focused solely on strategy-training? Would near transfer be possible if both performance and self-regulation changed as a function of training?

Overall, this research demonstrated that a brief name recall strategy training program is effective for middle-aged and older adults. The training program constituted two hours of in-person instructor-led training and approximately two to three hours of

continued self-study at home. Compared to performance at pretest and to performance of inactive waitlist control participants, training produced improved name recall memory, higher levels of memory self-efficacy, and more effective use of memory strategies. Contrary to expectations, benefits from training were similar for a beliefs-focused strategy training approach, as compared to a content- and duration-matched training approach without the focus on beliefs. However, benefits from both training approaches extended beyond the targeted name recall task that was trained to performance on similar, but untrained, associative memory tasks.

Effectiveness of Brief Memory Training Program

The first aim of this study, EMC-R, was to test the effectiveness of an abbreviated memory strategy training program focused on techniques for name recall. Consistent with previous research (Gross et al., 2012; Verhaeghen & Marcoen, 1996), the training program was effective in terms of performance gains on the target task. The primary contribution to the cognitive intervention literature here is that EMC-R was also effective in enhancing memory self-efficacy and effective strategy use. The finding that EMC-R enhanced self-regulatory factors has several practical implications, particularly increased “bang for the buck” in terms of benefits beyond improved name recall performance – enhanced self-evaluative beliefs and more effective strategy use – that is important to practitioners and trainees alike.

Most training programs have not directly assessed gains in self-evaluative beliefs for middle-aged and older adults, but among programs that did, only some were successful (West & Strickland-Hughes, 2015). A meta-analysis by Floyd and Scogin (1997) suggested that memory training can improve subjective beliefs about memory, although this effect was of much smaller magnitude than the benefit to memory

performance. Importantly, EMC-R was unique from the past successful training programs because of its shorter duration and lower intensity. The original EMC project (West et al., 2008) was successful in enhancing trainee's personal control beliefs and memory self-efficacy, but training lasted five weeks. ACTIVE trainees demonstrated improved sense of personal control beliefs, but the ACTIVE training program lasted ten weeks (Wolinsky et al., 2009), and personal control benefits were limited to trainees in the speed of processing and reasoning training conditions, not memory strategy trainees. An 8-week-long group training with 2-hour weekly meetings was effective in enhancing memory self-efficacy one week and four months following training (Valentijn et al., 2005), when statistically controlling for age, gender, educational level, and baseline scores. Older adults with memory complaints reported enhanced memory control beliefs immediately following six weeks of training with weekly 2-hour classes, but without any improvement to objective memory performance (Rapp, Brenes, & Marsh, 2002).

Clearly, the duration of these training programs far exceeded that of EMC-R, and there has been limited evidence of the benefits to beliefs from short-term training. In fact, Woolverton and colleagues (2001) directly compared "short" and "long" versions of memory training and found that the short version was not as effective as the long one, in terms of both objective and subjective memory gains. Notably, the "short" version of the training was designed to last approximately 13 hours over as many days, significantly longer than EMC-R. Thus, the self-evaluative beliefs gains in EMC-R are remarkable given that this training was comparatively short in relation to other successful programs.

In addition to enhanced self-evaluative beliefs, EMC-R trainees reported more effective strategy use than control participants. Evidence of effective strategy use by EMC-R trainees is important because strategy use is often assumed but rarely assessed (West et al., 2000; West & Strickland-Hughes, 2015) and because it further supports enhanced self-regulation from this training program. Despite the rare assessment of strategy use in training programs, researchers often assume that memory gains are due to use of the trained strategies. Indeed, a review of strategy use across twelve interventions suggested that trainees increased strategy use over time, compared to control participants (Gross & Rebok, 2011), but much more research is needed to determine the extent to which strategy use may be more effective following training. For example, few EMC trainees reported using all the trained strategies, and many reported only using the simpler parts of advanced strategies (West et al., 2008). This finding is consistent with research that suggests older adults may over-rely on familiar strategies (Fisher, 2012).

Effective strategy use represents self-regulation in that it requires flexible adaptation to the task at hand, in response to continued monitoring of performance. This self-regulation via effective strategy use was indicated by EMC-R trainees: EMC-R trainees reported using a greater number of strategies overall and a greater proportion of trainees, compared to control participants, reported preferred use of strategies that were related to superior performance. This suggests that trainees were selectively focusing their strategic effort on techniques that were advantageous.

Theoretical and empirical work considers that self-regulation may be key to maximizing the impact of training on memory (Hertzog & Dunlosky, 2012; West &

Strickland-Hughes, 2015). Self-evaluative beliefs are related to greater training-related improvements in cognition (Jaeggi et al., 2014; Payne et al., 2012; West et al., 2008; West & Hastings, 2011). Beliefs are also related to concurrent memory performance (Beaudoin & Desrichard, 2011), and predict memory performance up to six years later (Valentijn et al., 2006). ACTIVE memory trainees, compared to control participants, used a greater number of memory strategies up to five years following training (Gross & Rebok, 2011), and in turn training-related memory improvements were also maintained over this period (Willis et al., 2006).

These benefits of training are notable, but training can only be effective if it can be completed. The true strength of EMC-R is the possibility of broad dissemination, given its brief duration. Training that occurs over a single week, with only one 2-hour class, could easily be offered as part of existing programming at Senior Centers and lifelong learning programs, whereas extended training would not be compatible across a wide range of settings. To this end, future work should assess the external validity of EMC-R. Warranted first are assessments of the efficacy of the program when administered by non-memory experts, such as activities staff or volunteer peer leaders, with minimal training (e.g., Noice & Noice, 2013), and when samples of trainees are more diverse in terms of level of education, race and ethnic background, and gender.

Additionally, scholars suggest that training should focus on specific memory tasks that are important to trainees (McDaniel & Bugg, 2012; Woolverton et al., 2001), and some of EMC-R's success may have been derived from the high value that middle-aged and older adults place on name recall (Dark-Freudeman et al., 2006; Strickland-Hughes et al., 2016). Thus, replications of this brief training focused on other types of

everyday memory, such as story recall, which was improved in EMC (West et al., 2008), would logically extend the impact of this training.

Beliefs-Focused Versus Strategy-Only Training Approaches

The previous EMC project, on which this research was based, applied self-efficacy theory (Bandura, 1997) in its design and was successful in enhancing trainees' self-regulation, as well as memory performance (West et al., 2008). Because EMC research compared trainees to inactive control participants, the specific impact of this training design was unknown. Considering the modest evidence for self-regulatory benefits from relatively long training programs (discussed above), it may be that these gains were derived simply from completing memory strategy training, and not from a training approach focused on self-regulation. The present research, EMC-R, aimed to clarify this issue by comparing a beliefs-focused training approach to a content- and duration-matched traditional approach focused on strategies only. Contrary to expectations, no relative benefit for the beliefs-focused group was found, in terms of gains in memory performance or self-regulation or near transfer.

Potentially, training differences between the beliefs-focused and strategy-only conditions were comparable due to the brief time course of training and testing. First, additional time post-training may be necessary to reveal the relative benefits from a beliefs-focused training approach. In EMC, self-evaluative beliefs were assessed one month, but not one week, following training (West et al., 2008), and latent growth curve modeling suggested that self-evaluative beliefs and training-related gains in these beliefs influenced memory performance one month following training (West & Hastings, 2011). Further, a primary technique for name recall taught in EMC and EMC-R was the image-name-match technique, but this technique is complex, and trainees' might

require additional time following training to maximize the potential of this strategy. Indeed, as in EMC, very few persons in EMC-R reported using the complete image-name-match strategy. To test this supposition, a future project could replicate the EMC-R name recall training with follow-up assessments at least one month after training.

In theory, better self-regulation might enhance training effects to the extent that it promotes persistent effort, when facing challenges. Partial support of this supposition comes from past research. Highly compliant EMC trainees who were more engaged with the training program, and completed more of the activities, gained more from the training (Bagwell & West, 2008). Further, in a working memory training paradigm, greater motivation to complete training, in terms of greater need for cognition or a growth mindset, was related to more training-related gains (Jaeggi et al., 2014). In this particular study, relatively high intrinsic motivation across both training groups, or other individual characteristics of trainees, might have “overridden” possible gradation of gains between the training approaches. Individuals who are relatively disadvantaged in terms of motivation or baseline self-regulatory factors might gain more from a beliefs-focused approach, while individuals already “rich” in those resources might not demonstrate incremental benefit from this approach, or may need a higher “dose.” Such a moderation of training effects would be consistent with the role of memory self-efficacy in goal-setting and feedback effects for memory (West, Ebner & Hastings, 2013). This supposition could be tested by assessing motivational factors prior to training, pre-selecting individuals with lower scores on self-regulation measures, or by manipulating motivation via varied participant recruitment or payment procedures (Jaeggi et al., 2014).

The most parsimonious explanation for the comparable training outcomes between the beliefs-focused and strategy-only training approaches is likely the limited training duration. Although many differences between the two training approaches were documented, the abbreviated nature of EMC-R may not have allowed for sufficient presentation of elements that can enhance self-regulation. Some elements to enhance self-regulation are fundamental to any strategy training, such as repeated practice of skills and modeling of each strategy. Additional elements are inherent to training conducted in groups, such as having the whole group practice strategies together or possible social support from other group members. Indeed, this may be why group training is consistently more effective in terms of memory gains than individual, self-help training (Gross et al., 2012). To better understand the role of groups in beliefs-focused training, future work might use self-study individual training and active social groups as control conditions.

In the present study, the two groups differed in the extent that the instructor emphasized process/learning, rather than 100% scores, and trainees' potential for improvement. There was also more general positive feedback during the beliefs-focused classes. The beliefs-focused group had a specific reading designed to help individuals adapt to age-related memory changes. Training materials for the two groups also differed in the ordering of exercises, with easier first to encourage incremental mastery for the beliefs-focused trainees. Even though this list indicates a large number of differences between the two groups there are other possible elements to enhance self-regulation that were limited here or were impractical to include within a single week. For instance, the longer EMC training program also included greater opportunities for in-

class success using different strategies (including the learning of fellow classmate names) and small-group discussions of homework questions to help trainees understand the homework readings. The most important of the EMC elements, dropped here due to time constraints, may have been specific goal-setting for performance gains and positively-framed objective feedback on trainee's progress. Goal-setting and feedback may be critical for boosting training gains, given their impact on performance across adulthood (West et al., 2013). Comparison of training approaches with and without goal-setting and provision of objective feedback on interim training gains is recommended, especially if investigators can identify a way to incorporate goal-setting and feedback while still maintaining a relatively short-term training approach.

Evidence for Near Transfer

The most important contribution of EMC-R to research on cognitive interventions for older persons may be the evidence for near transfer. That is, even though the EMC-R strategies and practice exercises focused on learning and remembering name-face pairs, trainees, but not control participants, demonstrated improved performance on the untrained, occupation-name recall tasks (immediate and delayed). Of the four transfer tasks, correlations between performance on these two and the targeted name recall task were larger than those between the occupation-name delayed recognition task and the object-location delayed recall task. Further, the two occupation-name recall tasks were the most difficult of the transfer outcomes. Contrary to expectations, trainees in both the beliefs-focused training condition and the strategy-only training condition demonstrated pre-post improvements in these transfer tasks. Regardless, evidence for near transfer in this present study is particularly important given the controversy surrounding generalization and transfer in cognitive interventions (Fisher, 2012) and the

decidedly limited evidence for transfer effects from past memory strategy training programs (Zelinski, 2009).

Researchers agree that memory strategy training programs are effective in enhancing performance on trained tasks, immediately following training, but extensive debate surrounds the what, when, and how of transfer effects (Fisher, 2012). Controversial is the “generalist assumption,” suggesting that training gains are overstated because the benefits are limited only to the trained tasks, and only immediately following training (McDaniel & Bugg, 2012). As such, demonstrating transfer to untrained tasks that are similar to the targeted ability has nearly become a search for the “holy grail” of cognitive interventions.

Evidence for transfer from memory strategy training is so rare that some scholars have proposed it should be circumvented by directly training the tasks that older persons want to enhance (McDaniel & Bugg, 2012), or by taking novel and alternative approaches to training, such as focusing on overall cognitive engagement (Stine-Morrow & Basak, 2012; Stine-Morrow et al., 2007; Rebok et al., 2007). Some even suggest aborting the search for transfer from strategy training in favor of other types of cognitive interventions, such as those that offer extensive practice of core competencies (Zelinski, 2009). Indeed, transfer is more often observed with cognitive interventions that train core competencies, such as working memory, attention, or speed of processing, or that involve extensive practice of such skills, as in video game training (Jaeggi et al., 2008; Jaeggi et al., 2014; Kueider et al., 2012; Morrison & Chein, 2011; Toril et al., 2014). However, other scholars maintain that near transfer from memory strategy training is a reasonable goal, proposing that transfer might be promoted with

support (Fisher, 2012). Supports might include enhanced monitoring skills (Dunlosky et al., 2007; Dunlosky et al., 2003), encouragement to apply the learned strategies to new tasks (Cavallini et al., 2011), or changing the modality or location of training to more closely match the intended transfer settings, e.g., offering training at home to promote transfer to “real world” memory (Rebok et al., 2007).

An alternative solution may be to design memory strategy training programs using a theoretical model to foster transfer – and this may be a primary reason for EMC-R’s successful evidence of near transfer. Barnett and Ceci (2002) propose that a key issue in identifying transfer effects, across varied disciplines, is poor definition of what constitutes transfer and why. They proposed a taxonomy of classifying transfer according to the content (what is transferred) and the context (the when and where of the learning and the transfer), and this taxonomy has been applied to a review of memory training for older adults (Zelinski, 2009). Regarding the context of transfer, Barnett and Ceci propose that transfer is most likely (1) when transferring from a “deep” general principle to a “superficial” specific task, (2) when the type of trained and transfer assessment outcomes (e.g., accuracy, speed) are identical (e.g., both speed or reaction time; both accuracy-based), and (3) when the successful implementation of the trained procedures to the transfer task require minimal memory demand.

EMC-R met some of these criteria that are theorized to promote transfer. First, the training program was multifactorial. That is, trainees learned “deep” general principles, because the course covered how to enhance attention, knowledge about how memory works, and important age-related memory changes. And, EMC-R also covered “superficial” specific strategies, such as the image-name-match method for

learning names. Second, both the target and the transfer assessments, as well as the practice exercises, focused primarily on accuracy as the outcome, although speed was introduced as a secondary outcome for some of the more difficult practice exercises that were timed. Taken a step further, both the target task and the transfer tasks required associative memory skill, which relies on the ability to bind two pieces of information together. This skill often declines in late life (Naveh-Benjamin, Guez, Kilb, & Reedy, 2004). Notably, near transfer in EMC-R was suggested for the occupation-name recall tasks (immediate and delayed), which were more similar (per intercorrelation coefficients) to the targeted name recall task than the occupation-name delayed recognition task or the object-location delayed recall task. However, for EMC-R, successful application of the trained procedures to the transfer task did challenge memory. Participants would have needed to recall the strategy that they learned while evaluating its effectiveness for the new task at hand. Thus, transfer may have occurred because considerable thought went into the design of the transfer tasks, as well as the development of appropriate multifactorial elements for the training program.

The self-regulatory gains associated with EMC-R training may also deserve credit for the successful near transfer evidenced by EMC-R trainees. Trainees in both the beliefs-focused and strategy-only training groups reported enhanced self-evaluative beliefs and more effective strategy use following training. Likely these concurrent self-regulatory benefits from training enabled trainees to adapt their approach to the associative memory testing in a way that led to improved performance on the untrained tasks. Modest empirical evidence and theory suggest that enhanced self-regulation might promote near transfer. For example, individuals trained to use self-monitoring for

a specific memory task can effectively transfer the use of this self-regulatory strategy to other memory tasks, with instruction (Cavallini et al., 2010). Bandura (1997) posits that self-regulation is key to task motivated behavior, task persistence, and, ultimately, task success. Reasonably, if an EMC-R trainee felt more confident in her ability to complete memory activities, she might maintain effort longer on the challenging occupation-name task, than if she did not feel confident in her capability to succeed on this task. Similarly, the flexible adaptation and performance monitoring that likely underlies more effective strategy use might easily translate to different memory tasks, as long as the trainee has knowledge of strategies she might employ. Theoretically then, greater effectiveness of one's self-regulatory system overall could contribute generally to task success, including performance on untrained memory tests.

Limitations

While the results of this research are quite promising, some possible limitations will need to be addressed in future research. Sample selectivity may restrict the extent to which study results might be generalized. The sample was selective in terms of sex distribution, level of education and self-reported health, and, potentially, motivation to complete the study. Additionally, results of the study cannot address long term trajectories of training impact.

The clear majority of the study sample was female participants. Well-documented sex differences evidence that women outperform men on episodic recall, name recall, and face recognition in mid-life and old age (de Frias, Nilsson, & Herlitz, 2007; West, Crook, & Barron, 1993). Because the proportion of female participants were comparable across the three experimental conditions, these sex differences for memory were likely

not a confound for group differences. However, future research is needed to confirm whether the training benefits generalize to middle-aged and older men.

The participants in the present study were also relatively well-educated and healthy, compared to the general population of middle-aged and older Americans. Current debate in cognitive intervention literature questions who benefits the most from training. Some scholars propose a Matthew Effect, wherein those persons who are already relatively advantaged, in regards to cognitive capacity, education, or health, benefit most. Alternatively, greatest gains might be evidenced by relatively disadvantaged persons who have more to gain (Hertzog et al., 2009; Stine-Morrow & Basak, 2011). Results of this research do suggest that relatively advantaged persons in terms of education and self-reported health can benefit from brief strategy training for name recall. However, future research is needed to determine whether people with relatively low levels of education or below average health would benefit as much or more from this sort of training program.

Participant recruitment materials advertised an everyday memory training program, and participant payments were the training materials. Thus, participants likely self-selected based on interest in improving their memory abilities. Considering this, the study sample may have had greater subjective complaints or more concerns about memory performance than the general population. Such selectivity would be concerning because subjective memory complaints are related to objective memory performance and may be a precursor to cognitive decline (Crumley et al., 2014; Reid & MacLullich, 2006). However, pretest memory self-efficacy and general memory evaluation scores for this study were consistent with baseline values observed across six non-training

memory studies from the same geographic area in Florida (cf. West, Bagwell, & Dark-Freudeman, 2005; West et al., 2009; West, et al., 2003; West, Welch, & Thorn, 2001; West & Yassuda, 2004). These data suggest that the sample was not disadvantaged in terms of memory complaints. Further, because participants in the three different training conditions did not differ in baseline measures of working memory, episodic memory, or general memory evaluation, this selectivity – if present – would not have confounded comparisons made between these groups.

The study recruitment and compensation procedures may have also attracted participants with high levels of intrinsic motivation to complete the training program, which could have further supported training gains. The low attrition rate in this study, which was unrelated to experimental condition, further suggests that participants may have had high intrinsic motivation to complete the training. Across two working memory interventions, Jaeggi and colleagues (2014) evidenced that intrinsic motivation may promote transfer of training. This training program also provided novel evidence of near transfer, and the sample may have been intrinsically motivated to complete the training. However, whenever participants are recruited for training, per se, motivation could interact with training effects. If motivation is related to recruitment, then motivation should have also been present in the control group which did not show changes comparable to the trained group on most variables. Future work could directly assess or manipulate participant motivation to examine its effect on the practical impact of training.

This research provides key evidence regarding the practical impact of training by demonstrating training-related gains on trained and untrained memory tasks, as well as

improvements in self-regulatory factors, immediately following training. However, because assessments were only administered in the weeks immediately before and immediately after training, data from this research cannot evaluate longer-term trajectories of training-related change. Cognitive researchers and aging persons alike are concerned with temporal transfer of training and question whether training-related gains are sustained, and, if so, for how long (Hertzog et al., 2009), and evidence for long-term training benefits is limited (Bottiroli et al., 2008; Rebok et al., 2014). Training-related gains from the present study may not have persisted beyond the week, or they might have been sustained or even magnified, and the long-term trajectory of training effects may differ between the beliefs-focused training approach and the strategy-only training approach. These possibilities should be tested in future work with long-term follow-up assessments.

Conclusion

Collective results from cognitive intervention research demonstrate that middle-aged and older persons may show test score improvements with small amounts of training (Gross et al., 2012; Hertzog et al., 2009), but researchers and trainees alike are concerned with the true practical impact of these programs. Researchers debate whether training change trainees' self-regulation – how they evaluate their abilities and approach the task at hand – as this could promote self-sustaining performance gains (Hertzog & Dunlosky, 2012; Strickland-Hughes & West, 2017). Controversy also surrounds the scope of training benefits: are gains limited to performance on the targeted tasks? Individuals seeking training wonder whether they will be able to perceive a benefit from training and if the time or effort required is reasonable. EMC-R provides insight towards resolution of these controversies with its tentative but optimistic

evidence that short-term strategy training can enhance self-regulatory factors and that benefits might generalize to similar, untrained tasks.

When considering interventions for memory and aging, it might be tempting to focus on improved memory performance as an ultimate goal. Consistent with past programs, EMC-R was effective in this goal, as performance on the trained memory task was improved for trainees compared to inactive control participants. However, performance is determined not solely by ability level but rather by the success of a comprehensive self-regulatory system including personal, behavioral, and environmental factors. As such, the true success of EMC-R was that the training enhanced specific self-regulatory factors, namely memory self-efficacy and effective strategy use. These factors may be key to sustained memory success as they are related to current and future memory performance. Other training research has suggested that enhanced self-regulation may be the special ingredient necessary for sizzling near transfer effects (Jaeggi et al., 2014; Payne et al., 2012; Strickland-Hughes & West, 2017). Certainly, results from this study support this supposition, as the training program benefited important self-regulatory factors, above-and-beyond enhancing memory performance, and the program also provided novel evidence for near transfer.

This research addresses contemporary controversy in the cognitive intervention literature by providing novel evidence that the practical impact of strategy training programs may generalize beyond the specific targeted task for middle-aged and older adults. Evidence of near transfer to other cognitive tasks have been depressingly limited, with the majority of evidence produced by interventions focused on extended practice, such as core skill training or training via computer or video games (Strickland-

Hughes & West, 2017). Thus, the modest evidence of near transfer in EMC-R is highly remarkable and may be the most meaningful finding from this research. The direct value of strategy training for a middle-aged or older trainees is immeasurably heightened if the benefits of the program are not limited to the specifically trained task. Although speculative and future research is necessitated, near transfer, if linked to self-regulatory gains, might extend to self-sustaining and perpetuating performance gains. Replication of this finding is warranted, as well as more comprehensive examination of specific training characteristics and individual differences that might further promote transfer.

Past research demonstrates that performance on targeted memory tests can improve with brief training (Gross et al., 2012; Rebok & Balcerak, 1989), but EMC-R's abbreviated training dosage is of great value, given its benefits to self-regulation and near transfer. EMC-R included approximately five hours of training, with only two of those hours in-person and instructor-led. From a practical standpoint, this training could thus be easily incorporated into existing programming, such as those at Senior Centers or in lifelong learning programs, unlike the longer programs that are typical in the literature (providing 10 to 20 hours of group strategy training). Further, the low cost of a single session program – in terms of both trainer time and participant time – may incentivize initial participation and full completion of the training for middle-aged and older adults. These benefits are important because memory training cannot be effective unless it can be offered and completed.

Collectively, EMC-R underscores the value of brief memory training for middle-aged and older persons. Five hours of training over a single week can not only enhance performance on the trained memory task but also improve self-regulation and untrained

memory performance. By focusing on memory strategies and self-regulation in training, the benefits from the training program could translate from the laboratory to trainees' everyday life. Active engagement in these programs will improve older people's memory lifestyle, aiding in many functional everyday activities and, ultimately, continuing their capacity to live independently.

APPENDIX A
STRATEGY CHECKLISTS

Techniques or Strategies for Recalling Names for Faces

Some people are able to use special techniques to help them to remember. Here is a list of memory techniques. We would like to find out the methods that you used. You may have concentrated on the faces and did not do anything else. Or you may have tried many different strategies to try to learn the names. Either way is fine. We are interested only in finding out exactly what you did while you were studying.

Please place a checkmark by all of the methods that you used while you were studying the names and faces.

- ☐ **1.** I concentrated and paid attention to the face.
- ☐ **2.** I concentrated and paid attention to the name.
- ☐ **3.** I tried to pick out prominent features.
- ☐ **4.** I tried to think of a meaningful association for the name.
- ☐ **5.** I repeated names over and over to myself.
- ☐ **6.** I tried to think of a concrete object to go with the name, e.g., “Gordon is a garden, Robin is a bird, George is a deep gorge.”
- ☐ **7.** I associated the face with the face of someone else I know.
- ☐ **8.** I associated the name with the name of someone else I know.
- ☐ **9.** I made up a sentence that described the person, e.g., “Frank looks like he would be frank and honest – he looks serious.”
- ☐ **10.** I made up a sentence that connected the person’s name and a prominent facial feature I noticed, e.g., “The red-red-Robin goes bob-bob-bobbin along” (very red cheeks).
- ☐ **11.** I created an image in my mind of the face.
- ☐ **12.** I created an image in my mind of the face with a prominent facial feature exaggerated.
- ☐ **13.** I created an image in my mind of the person with the name written across his or her face.
- ☐ **14.** I created an image in my mind of the person next to an object that fits the name, e.g., “Mr. Kohn with an ice cream cone,” “Mr. North with an arrow pointing north.”
- ☐ **15.** I used the image-name match method. I created an image in my mind of the person, identified a concrete object related to the name, and I imagined that object next to the person’s prominent facial feature.
- ☐ **16.** I covered the faces, looked away and tested myself on the names.
- ☐ **17.** Other method(s): Please describe. _____

Now go back through and review the list of things you checked.
Circle the 1 or 2 methods that you used the <u>most often</u> for remembering.

Techniques or Strategies for Recalling Locations of Objects

Some people are able to use special techniques to help them to remember. Here is a list of memory techniques. We would like to find out the methods that you used. You may have put the objects where you would in your own house and did not do anything else. Or you may have tried many different strategies to try to remember the object locations. Either way is fine. We are interested only in finding out exactly what you did while you were studying.

Please place a checkmark by all of the methods that you used while you were studying the object locations.

- ☐ **1.** I concentrated and paid attention to the rooms.
- ☐ **2.** I concentrated and paid attention to the objects.
- ☐ **3.** I concentrated on how the objects looked in the rooms.
- ☐ **4.** I repeated the locations of objects over and over.
- ☐ **5.** I paired the first letter of the object with the first letter of the room.
- ☐ **6.** I put the objects in logical rooms, where most people would expect to find those objects.
- ☐ **7.** I put <u>two</u> objects together in a room because the two objects logically go together (e.g., a lamp and table).
- ☐ **8.** I put <u>individual</u> objects where I put those same objects in my own house.
- ☐ **9.** I put <u>two</u> objects together because I have those objects placed together in the same room in my own house.
- ☐ **10.** I made up a sentence about the objects, one at a time, which matched each object to its room.
- ☐ **11.** I made up a story using many of the objects in their rooms.
- ☐ **12.** I created simple mental images of the objects in the rooms.
- ☐ **13.** I imagined a walk through the “house” seeing each object in each room.
- ☐ **14.** I made active mental pictures, like a movie, that showed the objects in the rooms.
- ☐ **15.** I closed my eyes, thought of the different rooms shown and checked whether I could list the object(s) I placed in each room.
- ☐ **16.** Other method(s): Please describe. _____

_____

_____

Now go back through and review the list of things you checked.
Circle the 1 or 2 methods that you used the <u>most often</u> for remembering.

Techniques or Strategies for Recalling Names for Occupations

people are able to use special techniques to help them to remember. Here is a list of memory techniques. We would like to find out the methods that you used. You may have concentrated on the occupations and did not do anything else. Or you may have tried many different strategies to try to learn the names. Either way is fine. We are interested only in finding out exactly what you did while you were studying.

Please place a checkmark by all of the methods that you used while you were studying the occupations and names.

- ☐ **1.** I concentrated and paid attention to the occupation.
- ☐ **2.** I concentrated and paid attention to the name.
- ☐ **3.** I repeated names over and over to myself.
- ☐ **4.** I repeated occupations over and over to myself.
- ☐ **5.** I repeated names and occupations together.
- ☐ **6.** I tried to think of a meaningful association for the name.
- ☐ **7.** I tried to think of a concrete object to go with the name, e.g., “Gordon is a garden. North is a direction.”
- ☐ **8.** I tried to think about the nature of the occupation, e.g., barbers cut hair with scissors; judges are wise and wear robes.
- ☐ **9.** I found the same letters in the name and occupation, e.g., “TATE is a TEACHER. WALKER is a BANKER.”
- ☐ **10.** I associated the occupation with someone I know who has that same occupation.
- ☐ **11.** I associated the name with the name of someone else I know.
- ☐ **12.** I made up a sentence that connected the name and occupation, e.g., “Franklin is a professor so he would be frank in his writings.”“Ms. Gor-don (the lawyer) wears a gor-geous suit in court.”
- ☐ **13.** I created an image in my mind related to the nature of the occupation.
- ☐ **14.** I created an image in my mind of a person with the occupation, and wrote the paired name across the person’s face.
- ☐ **15.** I created an image in my mind of a person with the occupation next to a concrete object that fits the name, e.g., “The astronaut Kohn with an ice cream cone.” “The painter North painting an arrow pointing north.”
- ☐ **16.** I covered the occupations, looked away and tested myself on the names.
- ☐ **17.** Other method(s). Please describe: _____

_____

_____

Now go back through and review the list of things you checked.
Circle the 1 or 2 methods that you used the <u>most often</u> for remembering.

APPENDIX B
OJBECT-LOCATION VISUAL ASSOCIATION MATERIALS

Table B-1. List of objects used in the object-location visual association task

Set A Objects		Set B Objects	
bottle	legal pad	ashtray	knife
box	light bulb	banner	magnifying glass
cigars	luggage	baseball	paper bag
clock	milk	blender	pen
comb	paint bucket	calculator	phone
dress	passport	calendar	pillow
dumbbell	perfume	camera	purse
envelope	radio	cassette tape	screwdriver
fire extinguisher	ring	crutches	shoes
flag	stapler	football	teapot
hole puncher	tennis racket	hand axe	trashcan
ladder	thumb tack	horn	wrench

Figure B-1. Example objects used in the object-location visual association task

Figure B-2. Example matrix array used in object-location visual association task

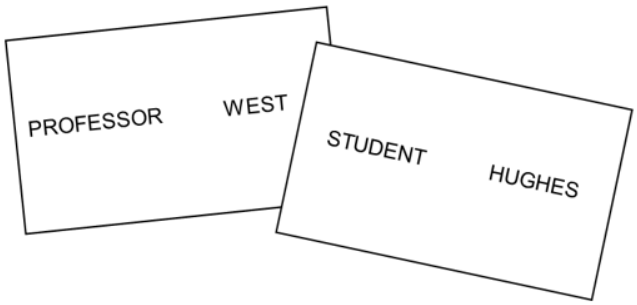
APPENDIX C
NAME-OCCUPATION VERBAL ASSOCIATION TASK MATERIALS

Table C-1. List of occupation-name pairs by set

Set A Pairs		Set B Pairs	
Occupation	Name	Occupation	Name
ARCHITECT	ALLEN	ACCOUNTANT	POTTER
CHEMIST	BENNETT	ACTOR	JONES
COMIC	OLIVER	ATHLETE	STEVENS
CONDUCTOR	WEAVER	BANKER	CARPENTER
DENTIST	WAGNER	BUILDER	BANKS
DESIGNER	JEFFERSON	BUTCHER	HARRISON
DETECTIVE	ROGERS	CLERK	FOX
DIPLOMAT	SCOTT	COACH	WATERS
DOCTOR	HUNTER	GARDENER	MITCHELL
DRIVER	HOWE	GROCER	WILSON
ENGINEER	GRAHAM	INVENTOR	MORTON
FIREMAN	BUTLER	LOGGER	MONROE
GUARD	BISHOP	MANAGER	KING
LAWYER	GRAVES	MERCHANT	DIXON
LIBRARIAN	SHEPHERD	PILOT	CHURCH
MECHANIC	GILMORE	PLUMBER	WELLS
MINER	SHOEMAKER	POLICEMAN	DAVIS
NURSE	COOK	POLITICIAN	BREWER
PAINTER	WILLIAMS	POPE	FLOWERS
PASTOR	STANLEY	POSTMAN	GILBERT
PRINCE	MORGAN	PRIEST	BARBER
PRINTER	WALKER	SALESMAN	SPENCER
RABBI	BERRY	SCIENTIST	HARDING
REPORTER	BAKER	SERGEANT	HAMILTON
RUNNER	STONE	SINGER	FISHER
SOLDIER	FLYNN	SURGEON	PETERS
TAILOR	DOUGLAS	TUTOR	BROOKS
TEACHER	BEARD	WAITER	HOBBS
USHER	MEADOWS	WELDER	FARMER
VET	CURRY	WRITER	KNIGHT

ON INSTRUCTIONS

For this task, you will study a set of OCCUPATION – NAME cards. Each of the cards has an occupation on the left, paired with a name on the right. In the example below, WEST is a PROFESSOR, and HUGHES is a STUDENT.



You will have 6 minutes to study the occupations and names on your cards. When the study time is over, you will turn to the next page in your answer packet. All of the occupations will be listed, like the example below. You will have 4 minutes to write the name that was paired with each occupation. You are not expected to remember every name. Just do your best.

Please write the name of the person with each occupation.

1. STUDENT _____ 2. PROFESSOR _____

After a few other activities, we will ask you again to write the name that was paired with each occupation. Even later in the session, you will do another activity with the occupations and names.

Figure C-1. Occupation-name verbal association task instructions

APPENDIX D
HEALTH AND MEMORY ENGAGEMENT SURVEY

Pretest Health and Memory Engagement Survey

Please give us the following information about yourself.
If needed, you can use more space on the back of this page.

---

1. Your date of birth: _____

2. Have you been hospitalized in the last year? ***If YES,*** please describe the reason(s) for each hospitalization. **Circle one:**
YES or NO

3. Is your physician currently treating you for any specific illnesses or health problems? ***If YES,*** please list these conditions. **Circle one:**
YES or NO

4. Please list any **prescription** medications you take regularly. If you DO NOT take any prescription medications regularly, please circle **"NONE"** below. If you DO take something regularly, please give the names of the medications and describe your reasons for taking each one. If you do not know the name of a medication, just list the reason you take it.

NONE

5. Other than vitamins, please list any **over-the-counter or non-prescription medications** such as *medicinal herbs, aspirin, cold medicines, etc*. that you have taken **within the past 48 hours**. If you have not taken any non-prescription medicines in the past 48 hours, please circle "**NONE**" below.

NONE

Please give us the following information about yourself. If needed, you can use more space on the back of this page.

Some memory training programs are offered with a personal instructor, others are offered online or with CDs/books.

6. Have you completed memory training with a personal instructor in the last year? ***If YES,*** please describe your training, including how long it took and the type of activities you did. **Circle one:** YES or NO

7. Have you completed memory training with guided instruction via computer, videos, or written materials, such as a workbook, in the past year? ***If YES,*** please describe your training, including how long it took and the type of activities you did. **Circle one:** YES or NO

For 8-11, please indicate how often you engaged in each activity within the last year. Do not worry if you cannot give an exact figure. Circle the letter that most nearly describes the frequency with which you have done the activity, using the scale below.

a. Never
b. Less than once a year
c. About once a year
d. 2 or 3 times a year
e. About once a month
f. 2 or 3 times a month
g. About once a week
h. 2 or 3 times a week
i. Daily

8. Exercise my memory with computer games or activities
a b c d e f g h i

9. Exercise my memory with games or activities not on the computer
a b c d e f g h i

10. Learn and practice new strategies for my everyday memory activities
a b c d e f g h i

11. Practice well-known strategies for my everyday memory activities
a b c d e f g h i

Posttest Health and Memory Engagement Survey

Please give us the following information about yourself.
If needed, you can use more space on the back of this page.

---

1. Your date of birth: _____

2. Have you been hospitalized **since your last interview** two weeks ago? ***If YES,*** please describe the reason(s) for each hospitalization.

Circle one: YES or NO

3. Has your physician diagnosed you with a new illness **since your last interview**? ***If YES,*** please list these conditions. **Circle one:** YES or NO

4. Please list any NEW **prescription** medications you have started taking **since your last interview**. If you are not taking anything new,
please circle **"NONE"** below. If you do not know the name of a medication, just list the reason you take it.

NONE

5. Other than vitamins, please list any **over-the-counter or non-prescription medications** such as *medicinal herbs, aspirin, cold medicines, etc*. that you have taken **within the past 48 hours**. If you have not taken any non-prescription medicines in the past 48 hours, please circle "**NONE**" below.

NONE

Please give us the following information about yourself. If needed, you can use more space on the back of this page.

Some memory training programs are offered with a personal instructor, others are offered online or with CDs/books.

6. **Other than the Everyday Memory Training program**, have you completed memory training with a personal instructor **since your last interview** two weeks ago? ***If YES,*** please describe your training, including how long it took and the type of activities you did.

Circle one: YES or NO

7. **Other than the Everyday Memory Training program**, have you completed memory training with guided instruction via computer, videos, or written materials, such as a workbook, **since your last interview**? ***If YES,*** please describe your training, including how long it took and the type of activities you did. **Circle one:** YES or NO

For 8-11, please indicate how often you engaged in each activity **since your last interview**. Do not worry if you cannot give an exact figure. Circle the letter that most nearly describes the frequency with which you have done the activity. Please consider activities you may have done for the Everyday Memory Training program as well as other activities.

8. Exercise my memory with computer games or activities

never								**daily**
a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**

9. Exercise my memory with games or activities not on the computer

never								**daily**
a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**

10. Learn and practice new strategies for my everyday memory activities

never								**daily**
a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**

11. Practice well-known strategies for my everyday memory activities

never								**daily**
a	**b**	**c**	**d**	**e**	**f**	**g**	**h**	**i**

APPENDIX E
HOMEWORK ASSIGNMENT SHEETS

Homework Assignment Sheet for the Strategy-Plus-Beliefs Condition

Homework

Please complete all homework before your next interview session or within one week, whichever comes first. Record the date and time spent on each activity on your **Activity Log**.

The purpose of the homework:

1) Show you a wide variety of memory techniques that you could use
2) Help you to learn the recommended memory strategies presented in class

Assignments

☐ Read ***Age and Memory.***

☐ Read ***How to Remember Names.***

☐ Complete a minimum of 40 minutes of practice with the exercises in the workbook.

☐ Find a picture in your home and use Active Observation to remember the details in the picture.

☐ Answer the homework questions below. Please write your answers on the back of this page (use back of Activity Log if you need more space).

1. Describe at least two age-related memory changes.

2. What should you do if you need more cues to remember?

3. Identify the name learning technique that seems like the best strategy for you. Use this method to remember at least one name this week. Report on how you used the strategy.

4. What kinds of activities do you do at home that are mentally challenging, that require you to think? Write at least two examples.

Do you have any questions about the homework assignments? If so, please contact us by emailing memory@psych.ufl.edu or calling (352) 273-3829.

Homework Assignment Sheet for the Strategy-Only Condition

Homework

Please complete all homework before your next interview session or within one week, whichever comes first. Record the date and time spent on each activity on your **Activity Log**.

The purpose of the homework:

1) Show you a wide variety of memory techniques that you could use
2) Help you to raise your scores by using the memory strategies from class

Assignments

☐ Read ***How Memory Works***

☐ Read ***How to Remember Names*.**

☐ Complete a minimum of 40 minutes of practice with the exercises in the workbook.

☐ Find a picture in your home and use Active Observation to remember the details in the picture.

☐ Answer the homework questions (below). Please write your answers on the back of this page (use back of Activity Log if you need more space).

1. How are working memory and long-term memory different?

2. How do memory cues work?

3. Use the sentence strategy from the reading on names to remember at least one name this week. Report on how you used the strategy.

4. What kinds of activities do you do at home that are mentally challenging, that require you to think? Write at least two examples.

Do you have any questions about the homework assignments? If so, please contact us by emailing memory@psych.ufl.edu or calling (352) 273-3829.

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BIOGRAPHICAL SKETCH

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