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Memory Strategy Instruction With Goal-Setting And Positive Feedback: Impact On Memory, Strategy Use, and Task Commitment

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MEMORY STRATEGY INSTRUCTION WITH GOAL-SETTING AND POSITIVE FEEDBACK: IMPACT ON MEMORY, STRATEGY USE, AND TASK COMMITMENT

By

Mercedes E. Ball

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By

Mercedes E. Ball
DEDICATION

This thesis is dedicated to the members of the Aging and Cognitive Training Lab at the University of the Pacific for all their hard work on the project to whom this project would not be complete without each of the members.
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MEMORY STRATEGY INSTRUCTION WITH GOAL-SETTING AND POSITIVE FEEDBACK: IMPACT ON MEMORY, STRATEGY USE, AND TASK COMMITMENT

Abstract

By Mercedes E. Ball
University of the Pacific
2021

Strategy instruction can improve memory performance, but some training programs are more effective than others. Some scholars propose that a key element to boosting the benefits from training programs is enhancing or emphasizing self-regulatory factors, such as knowledge about memory, beliefs about ability, or motivational factors. Research supporting this claim adds that programs that enhance trainees’ confidence in their abilities improve memory performance and multifactorial programs are more effective than strategy-training-only programs. Some training programs may include setting performance goals and receiving feedback that are two self-regulatory factors related to memory performance. However, previous research has not directly compared the effectiveness of strategy instruction with and without goal-setting and performance feedback elements. This was the purpose of the present study: We compared strategy instruction with goal-setting and positively-framed feedback across three assessments of memory performance, strategy use, and task commitment. Participants were 48 university students randomly assigned to two conditions. All participants watched a brief memory strategy video, but participants in the Strat+GFB condition set goals for their memory performance and received positively-framed objective performance feedback, whereas participants in the StratOnly condition did not. Research assistants conducted the experimental procedures individually with participants in 1-hour-long Zoom video calls. Primary outcome
measures (memory performance, strategy use, and task commitment) were assessed three times once before and twice after strategy instruction, with or without goal-setting and feedback between each test, depending on condition assignment. Shopping list recall tests were used to assess memory performance, and the number of to-be-recalled stimuli increased at each testing occasion as 15 additional items were added at each trial. Participants recalled more items, but a smaller percentage of the items, over time, and this pattern was not different for the experimental conditions. Additionally, number of strategies used, as self-reported on a retrospective checklist, increased from before to after strategy instruction. Importantly, the Strat+GFB condition maintained levels of commitment to the memory tests across the three trials, whereas the StratOnly condition reported drops in their task commitment. Study results emphasize that including self-regulatory factors, such as setting goals and receiving feedback, may increase commitment to a task, however those benefits may not immediately translate to better memory performance when training and testing is part of a brief, single experimental session. We suggest that future research evaluate a multiday memory intervention with the addition of goal-setting and feedback. Results of this study suggest that including goal-setting and feedback as part of a training program may benefit trainees’ commitment, which we speculate could aid individuals in maintaining persistent effort despite challenges and ultimately lead to better performance over a longer term.
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CHAPTER 1: INTRODUCTION

Memory is essential and valued (Nørby, 2015), but sometimes it fails us: We forget the name of that actor from that movie, misplace our keys and cell phone, or fail to recall something we know at trivia night or on a formal exam. The good news is that using memory strategies aid memory if used appropriately (Gross et al., 2012). Individuals can use strategies to attempt to improve performance. For example, when students are trying to learn new concepts for their classes, they might repeatedly repeat the concept and its definition to themselves to try to remember the concept for future use (Hinault, Lemaire, & Touron, 2017). Similarly, individuals may create visual images of grocery items interacting with each other when creating a grocery list to help them remember what they need to buy at the store (Hinault et al., 2017).

Most memory training programs are extensive and include instruction on using multiple strategies over weeks or longer (Cavallini, Bottiroli, Dunlosky, Ambiel, Lux, & Hertzog, 2019; Floyd & Scogin, 1997; Rebok et al., 2013; Verhaeghen, Marcoen, & Goossens, 1992). However, some research shows that instruction on using one or two strategies during a single experimental session can also be related to improvements in memory. For example, Hinault et al. (2017) investigated the combination of strategies compared to using only one method. They assigned participants to use two different techniques or a combination of those two strategies while encoding 30 pairs of words in a single experimental session. They found that younger adults who were non-students recalled more words using the combination of both interactive imagery and sentence generation strategies than using a single strategy alone. However, older adults who used strategy combination did not perform as well as those who used the sentence-generation strategy (Hinault et al., 2017). Similarly, Bailey, Dunlosky, and Hertzog (2014) evaluated young
adults memory performance after a brief strategy training. Participants assigned to the training group learned how to use different encoding strategies through a strategy training procedure. Participants in the training group completed a self-paced strategy training that consisted of learning about different strategies and then learned how to use the strategies when encoding a list of words. Those assigned to the control group completed an alternative activity that required as much time as the strategy training group to complete. Lastly, participants practiced using the strategies prior to being tested. Results showed those who used the trained strategies on the different tasks had gains in memory performance after training. This result suggests simple instruction on using one or two specific strategies during a single experimental session following training can be related to improvements in memory performance (Bailey et al., 2014).

**Bandura’s Social Cognitive Theory**

According to the social cognitive theory, individuals self-regulate their performance through a complex process of interactions among personal, behavioral, and environmental factors (Bandura, 1999a; Bandura, 1999b). These different factors impact performance when working both independently and together. For example, strategies can be a personal, behavioral, or environmental factor. Personal factors can include when individuals know how to use a specific strategy, whereas using a particular strategy on a task can be seen as a behavioral factor.

Additionally, an environmental factor that can aid in self-regulation of performance on a task is receiving strategy instruction about using a strategy can be seen as an environmental factor that can help regulate performance. However, knowing what strategies are and how they work to improve performance can be considered personal factors that individuals can use to self-regulate their performance. The decision to use and execute a strategy can be behavioral factors when monitoring performance. Similarly, goals set by an individual is also another behavioral
factor that can aid in self-regulation of performance. For example, individuals can set goals and see their performance on a specific task before and after the goal has been established. Feedback from our environment (e.g., peers) can help determine progress and further self-regulate our performance on tasks.

Personal beliefs about ability and tasks also play an essential role in self-regulation. For example, an individual’s level of task commitment, or the motivation to engage in procedures that help individuals progress through situations, can aid in an individual to self-regulate their performance on a task. This theory highlights that competence could explain performance and that performance is malleable through the self-regulatory system (Payne, Jackson, Hill, Gao, Roberts, & Stine-Morrow, 2012).

Reasonably, training programs with older and younger adults designed to improve these self-regulatory factors, in addition to the specifically targeted ability, should be more “effective” in terms of direct benefits from training and possibly their lasting impact (Strickland-Hughes & West, 2017; West & Strickland-Hughes, 2015). For example, Payne et al. (2012) found that older adults with more positive beliefs about their ability demonstrated more significant improvements in their cognitive performance following an inductive reasoning training intervention. Notably, participants with more positive beliefs about their ability also increased their time investment and perseverance on the training tasks. Similarly, older adults improved memory performance after a five-week-long memory training program due to increased memory self-efficacy (West, Bagwell, & Dark-Freudeman, 2008).

The present research examined the role of goal-setting, task commitment, and performance feedback in memory training. Unfortunately, researchers have not systematically compared when training incorporates goals to no goals or if training incorporates feedback.
However, significant research has established links between goal-setting and memory performance in adulthood with and without feedback.

Furthermore, some programs are multifactorial and include training elements or activities additional to the specific strategy training, such as focused attention, relaxation techniques, or education about how memory works (Strickland-Hughes & West, 2017). However, these multifactorial memory training programs, which have involved multiple components, have not systematically evaluated the impact of including goal-setting and feedback on memory performance. Other research may have embedded goal-setting and feedback in the training programs without recording or reporting the use. Similarly, evaluation of task commitment across multiple trials of a task needs further evaluation. Based on goal-setting theory, we believe that one key to promoting effective training is including goals and feedback and evaluating task commitment. This premise is the primary aim of the present research.

**Theoretical Perspective: Goal-setting Theory**

According to Locke and Latham (2013), having a challenging goal and seeing progress made towards that specific goal enhances an individual’s future performance and effort towards reaching that goal. Goal-setting can increase interest with routine, repetitive tasks by directing attention to goal-relevant activities and focusing on the task associated with a goal (Bryan & Locke, 1967); when goals are set by an individual or by an experimenter, motivation, attention, and goal-directed activities increase (Locke & Latham, 2002). However, the goal-setting theory states that when individuals set their own goals, goals tend to be higher, increasing performance and participant understanding of how to perform a task compared to those who did not set their own goals (Latham & Saari, 1979). For example, Harkins and Lowe (2000) examined self-set goals (e.g., asked to set a goal for their performance and write the goal they had picked on their
problem sheet), experimenter set goals (e.g., experimenter instructed: Based on previous research, we know that solving 150 problems is a difficult but attainable goal. I’d like you to try and attain the goal of 150 problems), and do-your-best instructions (e.g., told to do as many problems as they can) on an arithmetic task with undergraduate students. They found that those who set goals performed better than those who did not set goals. Specifically, younger adults for whom the experimenter assigned goals performed better than those given do-your-best instructions. Thus, having goals can further led younger adults to perform better on a specific cognitive task over time.

Additionally, feedback on self-set goals could enhance motivation and performance (West, Welch, & Thorn, 2001). Feedback allows individuals to complete a task to determine if more effort or resources are needed to attain their goal (Ashford & De Stobbeleir, 2013). For goals to be effective, feedback allows participants to adjust their effort level (Ashford & De Stobbeleir, 2013). When feedback and goals are present, performance may improve (Wood, Whelan, Sojo, & Wong, 2013). For example, Wack, Crossland, and Miltenberger (2014) tested goal-setting and feedback implementation on undergraduate students. They found that weekly goal-setting with performance feedback improved physical activity by increasing running distance compared to those who did not receive performance feedback. When provided with feedback on goals, progress on accomplishing those goals increases (Locke & Latham, 2002).

The type of feedback individuals receive on their performance is vital to performance outcomes (Wood et al., 2013). For example, West, Bagwell, and Dark-Freudeman (2005) found that those who had goals with positive feedback prompted higher goal commitment and subsequent goal-setting. They tested both younger adults’ (university students) and older adults’ memory performance across three trials where participants received either neutral or positive
feedback. Results showed younger adults who received positive feedback and set a goal increased performance across the memory trials compared to those with no goals nor feedback. Similarly, West, Strickland-Hughes, and Smith (2018) evaluated performance through two tests of name, text, and list recall tasks with young (university students) and older adults and compared goal and no-goal groups. They found both younger adults raised their performance more in goal-setting conditions than the control condition compared to older adults.

Illies and Judge (2005) also compared performance on the Remote Associates Test, which focuses on abilities to make associations, of undergraduate students who received negative feedback to those who received positive feedback. When feedback was negative, feedback predicted goal revisions on the next task, whereas positive feedback increased goals. Feedback is more robust when directed at an individual’s performance. Self-set goals are likely to result in more effort and ultimately improved performance.

**Strategy Use**

A strategy is a plan or pattern designed to achieve a goal (Locke & Latham, 2012). Task-specific strategies refer to knowledge applied to judgments and actions on a specific task, such as memory performance (Wood et al., 2013). Using strategies helps individuals develop action plans motivated by goals and achieving success in studies (Locke & Latham, 1994). Simple instruction on using specific strategies on memory tasks can enhance an individual’s performance on cognitive tasks by teaching an individual how to use a particular strategy (Hinault et al., 2017).

Unfortunately, behavioral use of strategies cannot easily be observed directly. First, some research employs “think aloud” techniques wherein participants explain their strategies in real-time. Some researchers assume that when participants are trained in strategies or instructed
to use them, they are used (and used correctly) if performance improves (Bailey et al., 2014; Hinault et al., 2017). However, demonstrating strategies may influence the person's specific strategy use and implementation (Jordano & Touron, 2018). For some types of memory performance, the order in which participants recall the learned stimuli can influence strategy use. This observational approach may provide the most objective assessment of strategies used but is limited to capturing only some specific strategies, such as clustering or grouping items together in a particular way (Gross & Rebok, 2011). The present research assessed strategy use with a retrospective checklist, where participants reported which strategies they used immediately after a memory task (West et al., 2008). Of course, this technique does require that participants have knowledge of the strategies they used and metacognitive competence to be aware of and recollect their strategy use. Perhaps because of these limitations, strategy use often goes unassessed.

Using a retrospective strategy checklist is better than not assessing strategy use because we can further assess if training leads to using better strategies to improve performance (Bailey et al., 2014)

We value the assessment of strategy use because successful implementation of strategies is a crucial behavioral self-regulatory factor shown to be necessary for memory performance. For example, West et al. (2009) tested both young (university students) and older adults who set a goal and received feedback and those who received neither. Strategies on the memory task were assessed using a retrospective checklist administered after the participants had completed the task. Those who received goal-setting and feedback used more strategies on the memory task and performed better than those who did not receive goal-setting or feedback. Additionally, performance gains have been seen in those who utilize strategies on different cognitive activities. One meta-analysis that reviewed 35 studies compared the differences of pre-post change between
memory-trained and control groups. The findings from this meta-analysis suggest that individuals involved in strategy training performed better than those not involved in strategy training (Gross et al., 2012).

**Task Commitment**

Task commitment is a type of bond that reflects dedication and responsibility for a particular target or task (Klein et al., 2012). Task commitment refers to one’s attachment or determination to attain the goal regardless of self-set or assignment (Klein et al., 2012). Since commitment is a psychological state, the use of self-report measures is the most appropriate method to determine an individual’s commitment to a specific target (Klein, Cooper, Molloy, and Swanson, 2014). The use of self-report measures to assess commitment demonstrates that individuals have some insight into their commitment to a given target (e.g., goal, decision, task).

The goal-setting theory states that setting goals overall help improve performance, suggesting that goal-setting might promote task commitment for those committed to improving their performance on a task (Locke & Latham, 2013). Task commitment has not been readily examined in memory training with the inclusion of goal-setting and feedback. Empirical studies have focused on evaluating commitment to a particular target (e.g., Klein et al., 2012). For example, Klein et al. (2014) provided evidence for the Klein et al. Unidimensional Target-free (KUT) measure of commitment validity and practical benefits across multiple targets that included a wide range of jobs, organizations, and industries. Specifically, the scale was used on a jury duty sample, an organization sample, and a student and alumni sample. Given the wide variety of disciplines, the present research is interested in whether goal-setting and feedback improve task commitment on a memory recall task in the context of memory training.
In theory, goal-setting works because commitment relates to better performance due to individuals already committed to performing better on the task. Among these alternative relationships between task commitment and performance, we will focus on whether goal-setting and feedback change individuals’ commitment to a memory performance task.
CHAPTER 2: PURPOSE OF PRESENT RESEARCH

The present research aimed to extend the literature on memory training examining the potential role of goal-setting and positively-framed objective feedback in boosting training effects. Previous research suggests that goal-setting and feedback improve memory performance (West et al., 2001; West et al., 2005; West et al., 2009; West et al., 2018). Some past memory training programs have included goal-setting and performance feedback for both younger and older adults compared to no goal-setting and feedback (West et al., 2005). However, none to our knowledge has directly tested whether goal-setting and positively-framed objective feedback magnify benefits from training programs.

Research Aims

Three questions guided this research: Compared to strategy instruction without goal-setting and positively-framed objective feedback, does strategy instruction with these elements lead to (1) better memory performance, (2) increased use of strategies, and (3) greater commitment to the memory task? We used a mixed factorial 3 testing occasions (within: Time 1, Time 2, Time 3) × 2 condition (between: Those who did not receive any goal-setting or feedback [StratOnly], Those who received goal-setting and feedback [Strat+GFB]) experimental design to test these questions. Research questions and hypotheses are described more below and are outlined in Table 1.

Research Question 1: Impact of Goal-Setting and Feedback on Memory Performance?

The first aim of the present research was to test the impact of strategy instruction on list recall memory performance. Given established practice effects and the general effectiveness of strategy instruction (Bottirol, Cavallini, Dunlosky, Vecchi, & Hertzog, 2013), we expected a
significant main effect of time. We hypothesized that participants would perform better on the list recall task across the three testing occasions (Hypothesis 1a). We also expected a main effect of strategy instruction condition: Overall, participants randomly assigned to receive goal-setting and feedback following strategy instruction were expected to perform better on the list recall task than participants assigned to the strategy instruction without goal-setting or feedback (Hypothesis 1b). Finally, we expected a significant interaction between condition and time with goal-setting and positively-framed objective feedback manipulation between Time 2 and Time 3 (Hypothesis 1c). We expected that memory performance would be similar for the StratOnly and Strat+GFB conditions at Time 1 before any goal-setting or feedback occurred. In contrast, we expected that memory performance would be superior for the Strat+GFB group than the StratOnly group at Time 3 after goal-setting and feedback presentations. Given the limited past research coupling strategy instruction and goal-setting and feedback, which individually may improve memory performance, we were uncertain if a memory performance difference between the two conditions will emerge at Time 2.

Research Question 2: Impact of Goal-Setting and Feedback on Strategy Use?

The second aim of the present research was to evaluate strategy use after brief strategy instruction was implemented. Using a retrospective checklist of strategy use (Strickland-Hughes, 2017; West et al., 2009), we tested whether reported strategy use increases following strategy instruction and whether this was moderated by goal-setting and positively-framed objective feedback. We hypothesized a main effect of time: All participants were expected to report using more strategies across the three testing occasions (Hypothesis 2a), meaning that there would be more strategies reported at Time 2 than at Time 1 and more strategies reported at Time 3 than at Time 2 following the strategy instruction and goal-setting and positively-framed
objective feedback. We also expected a main effect of condition where the Strat+GFB group reports more strategy use than the StratOnly (*Hypothesis 2b*). We did not have an a priori expectation for the Time × Condition interaction effect for reported strategy use, given the exploratory nature of this specific question. If receiving goal-setting and positively framed objective feedback was beneficial to memory performance, then more strategy use could be encouraged. More reported strategy use at Time 3 for the Strat+GFB group than the StratOnly group would result in a significant interaction effect. However, we did not formally hypothesize this effect, given limited past research and marginal effect sizes on goal-setting, feedback, and strategy use (West et al., 2009).

**Research Question 3: Impact of Goal-Setting and Feedback on Task Commitment?**

The third aim of the present research was to test whether the strategy training impacted task commitment (Klein et al., 2014) and whether those changes over time were different when goal-setting and positively-framed objective feedback were included with strategy instruction. Given the limited past research on task commitment tested sequentially in a single experimental session, and the limited past research evaluating task commitment in the context of strategy instruction or goal-setting and feedback paradigms, this aim was exploratory. We did not have a priori expectation for the main effect of time, the main effect of condition, or their interaction.

Following social-cognitive theory and goal-setting theory, as explained in the introduction, goal-setting and feedback might be motivational to participants and result in higher task commitment across the testing occasions for the Strat+GFB condition. Alternatively, some participants would experience fatigue or have lower motivation across the multiple testing occasions, and their task commitment would drop over time. Evidence of a decline in task
commitment for the StratOnly group, but not for the Strat+GFB group, would suggest that the
goal-setting and feedback helped maintain motivation or counteracts fatigue.
CHAPTER 3: METHOD

Study Design

The present research used a mixed factorial design for 3 testing occasions (within: Time 1, Time 2, Time 3) × 2 conditions (between: Strat+GFB, StratOnly). Participants were randomly assigned to two experimental conditions: strategy instruction with goal-setting and feedback (Strat+GFB) and strategy instruction only (StratOnly). This research focused on three outcomes: memory performance assessed via a list recall task, strategy use assessed via a retrospective checklist, and self-reported task commitment to the memory tasks. We assessed each outcome three times. All participants viewed a brief strategy instruction video and completed surveys. After each testing occasion, participants in the Strat+GFB group set goals and received positively-framed feedback on their performance on the previous testing occasion. The primary outcome measures – memory performance, strategy use, and task commitment – were tested three times: Time 1 (memory performance task before strategy instruction), Time 2 (memory performance task after strategy instruction, goal-setting and feedback), and Time 3 (memory performance task followed by goal-setting and feedback).

Participants

A convenience sample of 48 participants were recruited for the study. This sample size was informed by an a priori power analysis (Figure 1). Estimates of expected effect sizes and inter-assessment correlation were guided by past research and data from our lab on goal setting feedback and episodic memory training that reported effect sizes of $\eta^2 = .1$ to $.2$ and high repeated measures correlations, over $r = .85$ (Strickland-Hughes, 2017; West et al., 2001; West et al., 2003; West et al., 2009). Notably, with criterion set at $\alpha = .05$ and power (1-β) of .95 for a 2
between × 3 within RMANOVA, a sample size of 48 participants would be large enough to detect an effect size of $\eta^2 = .15$.

Eligible participants were undergraduate students at the University of the Pacific enrolled in a degree-seeking program. Participants were recruited through flyers (e.g., on-campus bulletin boards, handed out to students), social media posts, class announcements, and word of mouth (e.g., asking participants to recruit from their peers). One participant was excluded due to technical difficulties that resulted in the participant being disconnected from the session for approximately 20 minutes between the encoding and testing phases between Test 1 and Test 2. Therefore, a total of 47 participants were reported in the analyses. Table 2 summarizes demographic and background information for the entire sample and separately for the two conditions. Honorariums were participants’ choice among two SONA credits (exchangeable for extra credit in some classes at rates set by instructors, 72%), an entry into a raffle (one in four entries won a $20 Amazon egift card, 8%), or a $5 Amazon egift card (19%).

Measures

List recall. Episodic memory was assessed as performance on shopping list recall tasks. Participants studied lists of high-frequency grocery items adapted from West et al. (2001). Free recall of the list was tested immediately after encoding. Participants completed the list recall task three times. Each testing occasion increased in difficulty in terms of the number of to-be-learned words. The increase in the number of to-be-learned words were adapted from previous studies (West et al., 2001; West et al., 2005; West et al., 2008). At Time 1, participants had 1.25 minutes to encode 15 items and two minutes for recall. Time 2 included 30 items, the 15 items from Time 1 and 15 new additional items. Participants had 1.5 minutes to encode the 30 items and three minutes for recall. Time 3 included all items from Time 2 and 15 new additional
items. Participants had two minutes to encode the 45 items and four minutes for recall. Times selected for encoding and retrieving the items were based on West, Thorn, and Bagwell, (2003), West et al. (2005), and West et al. (2009).

Items were partially categorizable into common shopping list categories such as breakfast items (e.g., oatmeal, waffles), meats (e.g., roast beef, turkey), and office supplies (e.g., marker, paper clips). Items were nested in that items studied on earlier tasks were included in latter tasks. A complete list of to be remembered stimuli is included in Appendix C. Items were retrieved from West et al. (2008). During encoding, items were presented via screen share in Zoom by the research assistant. Stimuli were arranged in an array, such as the examples in Appendix C, and presented simultaneously to the participant. The words were displayed in all caps, with black font color on a white background. An example array with text of the same size and formatting was presented before Time 1 to ensure that participants were able to read the items.

Items were randomly assigned to the matrix position using random.org and then rearranged as necessary to follow specific rules. First, no more than two words from a single category were presented consecutively in a row or column. Second, items were not to be in the same position in the array across the three different testing occasions: Items newly introduced at the latter tasks and the repeated items were evenly dispersed. For example, at Time 2, the top half (first five items in each column) should be half previously studied items and half new items. Similarly, at Time 3 (top, middle, and bottom sections of columns) each column had one-third items first introduced each in Time 1 and Time 2.

**Scoring.** During recall, participants were instructed to *say all the words they can remember out loud, in any order.* The recall instructions were presented via screen share in
Zoom and read aloud by the research assistant. During the interview, research assistants used short-hand to write down the words recalled by participants during the session. This written note was used to estimate the number of correctly recalled words shared with participants in the Strat+GFB condition as part of the feedback manipulation. The written note also served as a backup for the audio and video recording of the Zoom interviews that was used for coding performance on the list recall task. Because the number of to-be-learned items increased across each testing occasion, list recall was scored as 1) the number of correctly recalled words and 2) the percentage of correctly recalled words. A strict scoring procedure was utilized wherein items needed to be recalled exactly (e.g., clips did not count for paper clips; mis-matched singular and plural items did not count). Research assistants also coded both intrusions and repetitions. Instructions were defined as words that were recalled that were not on the list of target words. Research assistants coded the number of unique instructions at each time but not the number of times those intrusions were recalled. Repetitions were defined as the number of unique target words that were recalled more than once but not the number of times the word(s) were recalled.

**Strategy use.** Strategy use was assessed using a retrospective checklist (West et al., 2009) immediately following recall of each list. Participants were asked to indicate the strategies they used during the most recent recall task from a list of common techniques. Strategies on this list varied in complexity, from simple techniques such as *I concentrated on each word* to advanced techniques such as *I made up sentences or stories to connect the items.* Fourteen common strategies are included on the checklist, and participants were allowed to choose “other” and describe additional strategies used. Participants were then asked to indicate which two strategies they found to be most helpful from their chosen strategies (West et al., 2009). A *strategy use* score was calculated as the sum of unique strategies checked and described by
participants. “Other” descriptions were coded as unique strategies if they describe a technique not on the list.

**Task commitment.** According to Klein, Cooper, and Monahan (2012), commitment is defined as a psychological bond that reflects an individual’s dedication to a specific target. Task commitment was assessed using the Klein et al. Unidimensional Target Neutral Commitment Measure (KUT), which includes 4-items answered on a Likert-type scale ranging from 1 = *Not at all* to 7 = *Completely* \((\alpha = .91;\) Klein et al., 2014). An example item is *How committed are you to this goal?* Task commitment scores were calculated as the mean ratings across the four items. Higher scores indicated a higher commitment to performing well on the memory task (theoretical range: 1-7; \(\alpha = .93\)).

**Additional Measures**

Additional survey measures were administered during the intermissions between testing occasions and at the end of the study for both groups. All surveys that were either administered by the research assistant or completed by the participant themselves were in random order except for the demographics, goal attainment questions, and the general memory evaluation. The surveys that were administered between testing occasions that assessed cognition were related to goals. These surveys are described in more detail below and the order of the surveys administered to participant is outlined in Table 3.

**Background and demographics.** Participants answered questions about their demographics and background, such as gender, major, and GPA, in a brief demographics survey after completing all measures (see Appendix D). Participants answered the questions regarding their background and demographics on their own after all testing occasions had occurred and responses were recorded in Qualtrics.
Goal attainment. Following procedures from (West et al., 2009), participants were asked three questions to assess their possible goal attainment at the end of the interview. The questions were: *Did you achieve your goals today*, *How much effort did you make on the memory tasks today?* and *If you had the opportunity to work on another list, to improve your performance, would you do it?* Responses were indicated on a 7-point Likert-type scale (1 = strongly disagree to 7 = strongly agree) where higher scores indicated a greater level of goal attainment. These questions served as a manipulation check for the feedback.

Dweck mindset instrument. Mindset is defined as beliefs that shape how individuals think, feel, and behavior in a situation (Dweck, 2006). Mindset was assessed using the Dweck Mindset Instrument, which includes eight items answered on a 6-point Likert type scale ranging from 1 = strongly agree to 6 = strongly disagree (Dweck, 2006). An example item is *You have a certain amount of intelligence and you really can’t do much to change it*. Scores were calculated as the mean across all items. Higher scores indicate a higher belief that one’s efforts can increase intelligence (theoretical range 1-6; α = .41). Research assistants read aloud each question to the participant in-between testing occasions and the participant’s answer was recorded in Qualtrics by the research assistant.

Achievement goal inventory. Goal achievement is defined as individuals' reaching the different goals they set forth for themselves (Grant & Dweck, 2003). Goal achievement was assessed using the Achievement Goal Inventory Items, which includes 18 items answered on a 7-point Likert-type scale ranging from 1 = strongly disagree to 7 = strongly agree (Grant & Dweck, 2003). These 18 items represent four different subscales that evaluate the types of academic goals students set, extent to which students compare themselves to peers to evaluate those goals, and the motivation students have to meeting their goals.
The Achievement Goal Inventory included four subscales that represent different goal focuses: Outcome Goals (3 items), Ability Goals (3 items), Normative Goals (6 items), and Learning Goals (6 items). Subscale scores were calculated as the mean for the items (theoretical range: 1-7). The Outcome Goals subscale assessed the goal of wanting to do well on a particular task (e.g., *It is very important to me to do well in my courses*; $\alpha = .85$). Higher scores on the Outcome Goal scale indicate a greater desire to perform well on a task. The Ability Goal subscale assessed how participants strive to validate their skills (e.g., *It is important to me to confirm my intelligence through my schoolwork*; $\alpha = .81$). Higher scores on the Ability Goal Items indicate that participants strive to prove the skills they have developed ($\alpha = .87$). The Normative Goal subscale assessed participant performance compared to others (e.g., *It is very important to me to do well in my courses compared to others*; $\alpha = .92$). Higher scores on the Normative Goal subscale indicate that participants evaluate their performance compared to their peers. The Learning Goal subscale assessed the extent of learning and developing new skills as major academic goals (e.g., *I strive to constantly learn and improve in my courses*; $\alpha = .86$). Higher scores on the Learning Goal subscale indicate that newly acquired skills are considered academic goals. Research assistants read aloud each question to the participant in-between testing occasions and the participant’s answer was recorded in Qualtrics by the research assistant.

**The metamemory in adulthood questionnaire.** The Metamemory in Adulthood questionnaire surveys subjects on their own memory functioning and their knowledge of general memory processes (Dixon et al., 1988). We administered five subscales from the MIA: Strategy (18 items), Achievement (16 items), Capacity (17 items), Anxiety (14 items) and Control (9 items). The Strategy subscale assessed knowledge of different memory strategies (e.g., *Do you keep a list or otherwise note important dates, such as birthdays and anniversaries?*; $\alpha = .81$).
The Achievement subscale assessed perception of motivation on performance on memory tasks (e.g., *It is important to me to have a good memory; α = .75*). The Capacity subscale assessed beliefs about one’s own memory ability (e.g., *I am good at remembering names; α = .80*). The Anxiety subscale assessed the perception of the relationship between an individual’s apprehension and performance on a memory task (e.g., *I get upset when I cannot remember something; α = .79*). The Control subscale assessed the sense of control on memory skills (e.g., *I can’t expect to be good at remembering zip codes at my age; α = .81*), scales. Research assistants read aloud each question to the participant in-between testing occasions and the participant’s answer was recorded in Qualtrics by the research assistant.

**General memory evaluation.** The General Memory Evaluation survey assesses individual’s global beliefs about memory (West, Dark-Freudeman, & Bagwell, 2009). The General Memory Evaluation included fours items answered on a Likert-type scale ranging from 1 to 7 (West, Dark-Freudeman, & Bagwell, 2009). An example item is *How important has it been to you to perform well on memory activities in your everyday life?* Memory evaluation scores were calculated as the mean across the items. Higher scores indicate greater perceived general memory ability (α = .70). Participants answered the questions to the survey on their own after all testing occasions had occurred and responses were recorded in Qualtrics.

**State anxiety.** Participants indicated how much they were feeling eight different emotions, (e.g., *jittery*) and *calm*, using an 8-point Likert-type scale from 1 = *Not at all* to 8 = *Very much* (Abrams, Eller, & Bryant, 2006). Anxiety scores were calculated as the mean across the items after reverse coding. Higher scores indicate a higher degree of anxiety on the memory task (α = .86). Participants answered the questions to the survey on their own after all testing occasions had occurred and responses were recorded in Qualtrics.
**Goal disengagement and reengagement.** Goal disengagement and re-engagement measure how easily participants reduce effort and recommend unattainable goals (Wrosch, Scheier, Miller, Schulz, & Carver, 2003). Disengagement and reengagement were assessed using the goal disengagement and reengagement scale, which included 10 items answered on 5-point Likert-type scale ranging from $1 = almost never true$ to $5 = almost always true$ ($\alpha = .89$; Wrosch et al., 2003). An example item is *It’s easy for me to reduce my effort toward the goal.* Disengagement and reengagement scores were calculated as higher scores indicate a greater protection of those who are ($\alpha = .78$). Participants answered the questions to the survey on their own after all testing occasions had occurred and responses were recorded in Qualtrics.

**Procedure**

Participants completed a 60-minute interview via Zoom. Research assistants were trained in ethical principles for working with human participants. First, research assistants explained the study procedures, risks, and benefits, and participants provided informed consent (Appendix E). The informed consent process started with research assistants screen sharing the informed consent form via Zoom, provided the link to a downloadable informed consent form and uploaded a .pdf version of the informed consent form to the participants chat within Zoom.

The informed consent form was presented bimodally as it was read aloud by the research assistant, presented on the screen, and available for the participants to download. Research assistants summarized key points of the informed consent such as participants being able to an item during the study and end their participation without consequence at any time during the interview. Participants provided initial consent to participate by the research assistant asking the participant, *Do you consent to begin to participate in this research study?* Participants answered either *Yes, I agree* or *No, I do not agree.* Research assistants proceeded with the study if
participants consented to participate. If a participant did not agree to participate in the study, the research assistant marked *No, I do not agree*. Research assistants were also instructed to answer any questions participants had.

If a participant agreed to participate, the research assistant then asked the participant for permission to record the interviews for quality control and data coding. All participants gave consent for recording the session. Additionally, 81% of participants had their video-enabled during the session. Research assistants enabled live transcripts and used clear speech techniques during the sessions with participants. The recordings of the interviews were uploaded to the Zoom cloud within University of the Pacific.

Participants completed three list recall tasks followed by 12-minutes of activities between each. An overview of the study procedures with relevant citations for measures and estimated times is outlined in Table 3.

For both experimental conditions completed Time 1 encoding, they completed the strategy checklist where participants indicated which strategies they used during the session and which strategies they thought helped them the most on the task. Participants in the StratOnly group watched the strategy instruction video then completed survey measures for the remainder of the 12-minute interval between testing occasions. Participants in the Strat+GFB group set goals and received feedback prior to watching the strategy instruction video then answered survey questions during the remainder of the 12-minute intervals between testing occasions.

Identical procedures were used between Time 1 and Time 2, and between Time 2 and Time 3. After Time 3, participants in the Strat+GFB received feedback on their performance but did not set goals. After feedback occurred, participants in the Strat+GFB group completed surveys. Participants in the StratOnly group completed surveys after Time 3. Both groups
completed the same survey measures in-between testing occasions that focused on metacognition. The strategy instruction and procedures for goal-setting and feedback are described in more detail below.

**Data entry and coding procedures.** Research assistants coded data twice by watching the recordings of the data sessions and coding the words the participant recalled during the interview session. Research assistants who coded the answer packet the first time did not code the same session the second time to ensure that there was an agreement on the coding of each variable between research assistants and to manage quality control of coding.

Research assistants recorded questions and issues with an “Notes” document. During weekly lab meetings, questions and issues were discussed with senior research assistants. If a research assistant had a question about how to code a variable, the senior research assistants determined the most appropriate way to code the variable.

To implement quality control of sessions, weekly lab meetings were held to discuss issues and concerns that occurred during the session. A “Notes” sheet was provided to the research assistants to note any remarkable event that happened during the session (e.g., participant lost internet connection, timer between sessions stopped working). An additional research assistant performed weekly quality control of videos and discussed suggestions for improvement with research assistants during weekly lab meetings. Quality control of videos was implemented to ensure that research assistants followed protocols for running the sessions.

**Strategy instruction.** A strategy instruction video was shown to all participants between Time 1 and Time 2 that was approximately five minutes long. Research assistants played the video via Zoom using the “optimize for video sharing” and “share computer sound” advanced sharing features. The strategy instruction was a slide presentation with audio and captions.
This training was directly adapted from a large scale successful training program, the Everyday Memory Clinic (Strickland-Hughes, 2017; West et al., 2008) that explained basic visual imagery and association techniques. For example, for associations, participants were taught that associations involved thinking of a meaningful connection or relationship between things to help them remember. For mental imagery, the video emphasized that memorable mental images are those that are interactive, vivid, and personally meaningful. In addition to explaining the techniques, the instructions included basic information about how memory works. The training was directed at a student audience to increase the salience and value of real-world examples to students participating in the study. Additionally, consistent with the past research from which this strategy instruction was adapted (Strickland-Hughes, 2017; West et al., 2008), the training included elements to boost self-efficacy through verbal persuasion and improved physiological states. One example of these elements from the instruction script is: *It is not about getting 100%, just about each person learning and improving.*

**Goal-setting and feedback conditions.** Participants were randomly assigned to either the Goal-setting and Feedback Condition (Strat+GFB) or the Strategy Only (StratOnly) condition. To demonstrate improvement across trials, participants in the Strat+GFB received objective positive feedback and set a goal for performance on the next task after each testing occasion. Participants in the StratOnly group did not receive feedback on their performance or set a goal. Instead, they were given information about the number of words that were on the task.

For the Strat+GFB condition, feedback was provided, adapting procedures from West et al. (2005). Research assistants immediately scored participant responses after each testing occasion. Following a script (see Appendix F), research assistants provided positively-framed
objective feedback on performance to participants assigned to the Strat+GFB condition.

Specifically, they indicated the number of items correctly recalled, e.g., Great! For Level 1 of the list task, you remembered about X of 15 words correctly. That’s really good. Research assistants encouraged the goals that participants set, e.g., That’s a great goal! I bet you can use the strategies from the training to meet your goal. Feedback between Time 2 and Time 3 also addressed progress towards attaining self-set goals, e.g., That’s pretty close to your goal – good job, you’re improving! if the goal was not met or That’s even more than your goal – good job, you’re improving! if the goal was exceeded.

Participants set goals for the performance on Level 2 and Level 3 of the memory task. After providing positively-framed objective feedback on their performance, the research assistants prompted participants to set a goal for performance, anchored at 10 additional words recalled. For example, after Level 1, they said:

*Level 2 of the list task will have 30 words total to remember. The 30 words will include the 15 from Level 1 and 15 new words. Other people typically remember about 10 more words when they do Level 2. What is your goal? How many more words do you want to remember for Level 2?*

The research assistant then recorded the goal in Qualtrics and provided encouragement towards the participant’s goal, e.g., That’s a really good goal. I know you can do it!
The primary goal of this research was to evaluate whether the addition of goal-setting and feedback to a brief memory strategy instruction enhanced the instruction-related benefits to memory performance, strategy use, and task commitment.

Analytic Procedure

To test our research questions, we conducted separate 3 testing occasions (within: Time 1, Time 2, Time 3) × 2 condition (between: Strat+GFB, StratOnly) mixed-factorial repeated-measures analyses of variance (RMANOVAs), one for each of our primary outcome measures. We checked all assumptions for parametric tests in general and specifically for general linear models and mixed factorial designs with repeated measures. When assumptions were not met, appropriate corrections were applied. For example, Greenhouse-Geisser corrected values for F scores are reported when the assumption of sphericity was violated. The observed means and standard deviations across the three testing occasions, as well as the intercorrelations among the three testing occasions, for both conditions are summarized in Table 4 (memory performance), Table 5 (strategy use), and Table 6 (task commitment).

Impact of Goal-Setting and Feedback on Memory Performance

Percentage of correctly recalled words. Memory performance, calculated as the percentage of items correctly recalled, was the first outcome measure. Results are illustrated in Figure 2. Mauchly’s Test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 10.60, p = .005, \epsilon = .82$. Thus, the Huynh-Feldt corrected values for the effect of time and the interaction between time and condition are reported. The main effect of time was significant, $F(1.74, 78.29) = 37.70, p < .001, \eta^2 = .46$. Follow-up pairwise comparisons suggested that,
across both experimental conditions, the percentage of words correctly recalled at Time 2 ($EM = .55, se = .03, 95\% \ CI [.50, .60]$) was lower than Time 1 ($EM = .68, se = .02, 95\% \ CI [.63, .73]$), $M_{diff} = -.13, p < .001, 95\% \ CI [-.17, -.09]$. The percentage of words correctly recalled at Time 3 was similar to the that at Time 2, $M_{diff} = -.01, p = .855, 95\% \ CI [-.05, .03]$, and lower than that at Time 1, $M_{diff} = -.14, p < .001, 95\% \ CI [-.19, -.09]$. This finding is inconsistent with Hypothesis 1a, which predicted better performance at the later time points. However, given that the number of to-be-recalled items increased at each time point, a smaller percentage of words recalled may represent gains in the total number of words recalled, which is reported in the next analysis.

The main effect of condition was not significant, $F(1, 45) = 0.71, p = .404, \eta^2 = .02$. Across all three time points, the percentage of words correctly recalled by the Strat+GFB group ($EM = .57, se = .03, 95\% \ CI [.51, .64]$) was similar to the percentage of words correctly recalled by the StratOnly group ($EM = .61, se = .03, 95\% \ CI [.54, .68]$). This finding was inconsistent with our expectations (Hypothesis 1b). Also contrary to expectations (Hypothesis 1c), the interaction effect between time and condition for percentage of words correctly recalled was not significant, $F(1.74, 78.29) = 0.54, p = .561, \eta^2 = .01$. The non-significant interaction effects indicates that we failed to observe a difference in the pattern of percentage of words correctly recalled overtime between the two experimental conditions.

**Number of correctly recalled words.** Given that the number of to-be-learned words increased at each testing occasion, we also evaluated the effect of time and condition on the number of correctly recalled words. Results for the number of to-be-learned words are illustrated in Figure 3. Mauchly’s Test indicated that the assumption of sphericity had been violated, $\chi^2(2) = 33.07, p < .001, \varepsilon = .65$. Thus, the Greenhouse-Geisser corrected values for the effect of time and the interaction between time and condition are reported. The effect of time
was significant, \(F(1,31, 58.89) = 171.32, p < .001, \eta^2 = 0.79\). Follow-up pairwise comparisons (Sidak correction) suggested that the number of correctly recalled words was different at each time point, \(ps < .05\). Participants in both experimental conditions remembered more words correctly at Time 2 than Time 1 (\(M_{\text{diff}} = 6.34, p < .001, 95\% \text{ CI} [5.07, 7.61]\)) and at Time 3 than Time 2 (\(M_{\text{diff}} = 7.76, p < .001, 95\% \text{ CI} [6.00, 9.52]\)). The main effect of the condition was not significant, \(F(1,45) = 0.65, p = .424, \eta^2 = .01\), inconsistent with our expectations (Hypothesis 1b). The interaction effect between Time and Condition for list recall was not significant \(F(1.31, 58.89) = 0.65, p = .465, \eta^2 = 0.01\), also inconsistent with expectations (Hypothesis 1c).

**Impact of Goal-Setting and Feedback on Strategy Use**

We compared the number of strategies reported being used by the two conditions across the three testing occasions. Results are illustrated in Figure 4. Mauchly’s Test indicated that the assumption of sphericity was met, \(\chi^2(2) = 4.00, p = .135\). Follow-up pairwise comparisons suggested that, across both experimental conditions, participants reported using a greater number of strategies at Time 2 (\(EM = 5.01, se = 0.26, 95\% \text{ CI} [4.47, 5.53]\)) than at Time 1 (\(EM = 4.21, se = 0.20, 95\% \text{ CI} [3.81, 4.61]\)), \(M_{\text{diff}} = 0.80, p < .001, 95\% \text{ CI} [0.30, 1.30]\). Participants reported maintained use of strategies from Time 2 to Time 3, as suggested by no evidence of a difference between the number of strategies used at Time 2 compared to Time 3 (\(EM = 4.94, se = 0.27, 95\% \text{ CI} [4.40, 5.48]\)), \(M_{\text{diff}} = -.07, p = .991, 95\% \text{ CI} [-0.69, 0.56]\). Further, the number of strategies reported being used at Time 3 was still greater than the number reported at Time 1, \(M_{\text{diff}} = 0.73 p = .022, 95\% \text{ CI} [0.09, 1.38]\). This is partially consistent with our expectation that strategy use would increase across each testing occasion (Hypothesis 2a).

Contrary to our expectations (Hypothesis 2b), the main effect of condition for strategy use was not significant, \(F(1,45) = 0.06, p = .804, \eta^2 < .01\). Results did not evidence a difference
in overall strategy use between the Strat+GFB group \((EM = 4.77, se = 0.29, 95\% CI \, [4.18, 5.35])\), and the StratOnly group \((EM = 4.67, se = 0.29, 95\% CI \, [4.01, 5.24])\), \(M_{\text{diff}} = .10, p = .804, 95\% \text{ CI} \, [-0.72, 0.92]\).

The interaction effect between Time and Condition was also not significant, \(F(2, 90) = 1.80, p = .171, \eta^2 = .04\). However, exploration of the follow-up pairwise comparisons suggested the reported strategy use for the two groups might be different over time. For the StratOnly group, strategy use increased from Time 1 to Time 2 \((M_{\text{diff}} = -1.22, p < .001, 95\% \text{ CI} \, [-1.93, - .50])\). Then, strategy use was maintained from Time 2 to Time 3 \((M_{\text{diff}} = -0.13, p = .977, 95\% \text{ CI} \, [-1.02, 0.76])\). On the other hand, a different pattern was demonstrated by the Strat+GFB group. Participants in the Strat+GFB condition, who set performance goals and received positive feedback between the testing occasions, reported a similar number of strategies across all three times, all \(ps > .05\).

**Impact of Goal-Setting and Feedback on Task Commitment**

We also explored the impact of goal-setting and feedback on participants’ self-reported commitment to the memory tests. Results for task commitment are illustrated in Figure 5. Mauchly’s Test indicated that the assumption of sphericity was met, \(\chi^2(2) = 5.42, p = .067\). The main effect of time was significant, \(F(2, 90) = 5.96, p < .004, \eta^2 = .12\). Follow-up pairwise comparisons suggested that, across both experimental conditions, task commitment reported at Time 2 \((EM = 5.90, se = 0.14, 95\% \text{ CI} \, [5.43, 6.18])\) was greater than task commitment reported at Time 1 \((EM = 5.73, se = 0.15, 95\% \text{ CI} \, [5.43, 6.02]), M_{\text{diff}} = 0.18, p < .001, 95\% \text{ CI} \, [0.06, 0.29])\). Task commitment reported at Time 3 \((EM = 5.82, se = 0.15)\) did not differ significantly from the reports from Time 1, \(M_{\text{diff}} = 0.09, p = .365, 95\% \text{ CI} \, [-0.06, 0.23]\), nor from Time 2, \(M_{\text{diff}} = -0.09, p = .209, 95\% \text{ CI} \, [-0.21, 0.03]\).
The main effect of goal-setting and feedback condition was not significant, $F(1,45) = 0.24, p = .625, \eta^2 = .01$. Results did not evidence a difference between overall task commitment between the Strat+GFB group ($EM = 5.89, se = 0.20, 95\% CI [5.49, 6.29]$), and the StratOnly group, ($EM = 5.75, se = 0.20, 95\% CI [5.34, 6.15]$), $M_{diff} = 0.14, p = .625, 95\% CI [-0.43, 0.71]$

The interaction effect between time and condition, however, was significant, $F(2, 90) = 3.19, p = .046, \eta^2 = .07$. At each time point, the level of task commitment reported by the two experimental conditions did not vary, $ps > .05$. Instead, the interaction effect was explained by a different pattern over time for the two conditions. For the StratOnly group, task commitment was constant between Time 1 and Time 2, $M_{diff} = 1.52, p = .063, 95\% CI [-0.31, 0.06]$. Then, task commitment dropped from Time 2 to Time 3, $M_{diff} = -1.85, p = .029, 95\% CI [-0.35, -0.15]$, to levels comparable to Time 1, $M_{diff} = 0.33, p = .973, 95\% CI [-0.18, 0.24]$. A different pattern was demonstrated by the Strat+GFB group: They reported gains in task commitment from Time 1 to Time 2, $M_{diff} = 0.20, p = .008, 95\% CI [0.04, 0.35]$. These gains were maintained at Time 3, when task commitment was similar to Time 2, $M_{diff} = 0.01, p = .998 95\% CI [0.16, 0.18]$. 
CHAPTER 5: DISCUSSION

The current research aimed to examine the role of self-regulatory factors on memory training. Past research that includes strategy instruction shows that memory performance and strategy use improve (Bottirolli et al., 2013; Hertzog et al., 2017; Hinault et al., 2017). Different self-regulatory factors, such as self-evaluative beliefs, motivation, goal-setting and feedback, could benefit from training (Jaeggi, Buschkuehl, Shah, & Jonides, 2014; Payne et al., 2012; Strickland-Hughes & West, 2017; West & Hastings, 2011). This research was the first to directly compare a brief strategy instruction with and without a goal-setting and performance feedback manipulation. We assessed memory performance, strategy use, and task commitment of a convenience sample of university students who were randomly assigned to two training conditions: with or without goal-setting and feedback. After the first testing occasion, a 5-minute video on strategy instruction was shown to all participants followed by two more testing occasions. Results did not provide evidence of better memory performance following goal-setting and feedback. Consistent use of reported strategies was apparent to participants who set goals and received over the three testing occasions, whereas the no-goals and no-feedback comparison group reported an increase (and then maintained) use of strategies after the instructional video. However, most interestingly, the goal-setting and feedback manipulation may have boosted task commitment. Those who set goals and received positively framed objective performance reported maintained task commitment over three trials, whereas participants who did not set goals or receive feedback reported declines in their commitment to the memory tasks.
No Evidence for Effect of Goals and Feedback on Memory Performance

Contrary to our expectations, results did not provide evidence of any differences in memory performance between the participants in both conditions. These tentative findings suggest that the addition of these self-regulatory factors may not improve memory performance directly. Results suggested that memory performance changed over time: Both experimental conditions recalled more words across the three testing occasions. Unfortunately, this result does not provide easily interpretable information about the efficacy of the strategy instruction, given the intentional omission of a “no instruction” comparison group and the incremental difficulty of the sequential memory tests (each having 15 more items to learn and recall than before).

This memory testing procedure was adapted from past studies on goal-setting, feedback, and episodic memory performance (West et al., 2001; West et al., 2003; West et al., 2005; West et al., 2008; West et al., 2009). Each of these studies utilized embedded memory tests, where sequential tests included previously studied and new stimuli with increasing number of words presented at each testing occasion. In the present research, the three list recall tests included 15, 30, then 45 items to encode and recall where each of the items from earlier tests were included in the later ones. Thus, participants should have been able to observe objective increases in the number of words recalled across the trials when received positively framed objective feedback. The addition of positively framed objective feedback could have aided in changes in performance being attainable by creating opportunities for participants to experience incremental mastery, which may support task-related self-efficacy.

Future analyses comparing memory performance might examine by the number of new versus previously studied words recalled correctly. For example, how many of the original 15 items were remembered at the second and third tests? This would be interesting for future
research to examine because it could be that when positively framed feedback is implemented, participants could either focus on the previous words they have already studied, they could focus on the new words in the next trial, or a combination of both. Further investigation on how participants study the words on the next trial could be of interest. If the addition of positively-framed objective feedback impacts how participants study the words, this could imply that the positively-framed feedback could impact how participants behave (e.g., study words).

Another interesting analysis could compare change scores between the experimental conditions. That is, the mixed factorial repeated measures approach used in this study permitted examination of level of memory performance across all three trials for the two conditions. We noted that, while not statistically significant, numerically the memory performance was lower for the goal-setting and feedback group than the no-goals and no-feedback group at the first memory test. Thus, comparing the difference scores (e.g., how many more words were remembered at Time 2 than Time 1) or reliable change scores (i.e., a standardized expression of the difference scores) between the two conditions may provide additional insight to potential impacts of the goal-setting and feedback on memory performance. Perhaps the goal-setting and feedback manipulation could relate to greater trial-by-trial gains or a greater change in remembering new words across the trials.

Replications of this research might sample different populations. The present research utilized a convenience sample of university students, and most participants selected extra credit for their honorarium (rather than a $5 gift card or raffle entry for a $20 gift card). However, the majority of research examining the impact goal-setting and feedback on memory performance has centered on middle-aged and older adults, and may have used younger adult samples as strawman comparison groups (Miller & West, 2010; West et al., 2018). Younger and older
adults may not have the same intrinsic motivation to improve their memory performance due to the pervasive negative stereotypes about aging and memory (Strickland-Hughes & West, 2021) and how memory is shaped by social and motivational factors (Hess, 2014). On the other hand, university students may be well-versed the basic memory strategies in the instructional video due to having more practice using the strategies in their collegiate careers.

Nonstudents may respond differently due to students conditioned to memorizing and learning. Since nonstudents may not be familiar with the strategies nor have the resources of memorizing and learning, it may be interesting to see the differences between the performance of nonstudents and students. However, the focus of this study was to compare the two experimental conditions and the internal validity superseded the external validity.

**Self-Reported Strategy Use Improved Over Time**

Overall, the reported number of strategies increased from before to after the brief strategy instruction. We speculate that the strategy instruction could have possibly promoted strategy use. However, without a comparison group who did not receive strategy instruction, we cannot disentangle instruction-related effects from practice effects. However, this research focused on directly comparing memory strategy training with and without goal-setting and feedback. Thus, the primary benefits from strategy-only training were outside the focus of this research. We instead rely on previous research findings that provide substantial evidence that brief instruction on memory strategies is related to better memory performance in single experimental sessions, compared to "no training" (Bottiroli et al., 2013; Cavallini et al., 2019; Hinault et al., 2017).

The increase in strategies used after the instructional video, compared to beforehand, was a significant main effect, including both experimental groups (those who received goal-setting and feedback and those who did not). The interaction effect between time and condition was not
significant. However, follow-up analysis suggested that the reported increased number of strategies used may have been particular to the group of participants who did not set goals or receive feedback. One explanation is that receiving positively-framed feedback may suggest to participants that their approach is effective and changes to their approach on the task is not needed for improvement. Future research might further explore this idea by asking participants to complete a self-regulatory reflection between memory tests or to indicate their response to the previous memory test and their “plan of attack” for the upcoming tasks. Other research might also test the impact of different types of feedback, such as formative feedback that encourages trying harder or is framed constructively.

In the present research, we assessed strategy through a self-report retrospective checklist immediately following each memory task (West et al., 2009). This may serve as a limitation because individuals might be inaccurate when reporting their strategy use or they may be reporting a more socially acceptable answer by reporting what strategies they used. For strategy use in particular, accurate self-report requires metacognitive skills where participants must be aware that a strategy is being used and they must intentionally try to use the strategy. For younger adults specifically, individuals may use memory strategies spontaneously or could be unaware that they are using a technique. However, the strategy checklist used in this study is simple and easy to administer, and it has been used in other previous goal-setting and feedback research (West et al., 2009). Follow-up analyses could also assess whether reported use of specific strategies on the check list are associated with better memory performance. The proportion of individuals in both experimental conditions using those more effective strategies – or reporting that those strategies were the one or two they used most – could be compared. Also, alternative techniques for assessing strategy use may be problematic in different ways. For
example, “think aloud” paradigms (Jordano & Touron, 2018) could further prompt individuals to use strategies more. Additionally, think-aloud procedures require metacognitive awareness of the process and could be demanding because people must focus on explaining the strategies and focusing on performing the task (Fox, Baldock, Freeman, & Berry, 2016).

Another benefit of the procedures used in the present study is that the strategy use can be examined objectively by examining the order in which the items were recalled. Use of some memory strategies, such as clustering techniques (e.g., recalling items from certain categories together) or recalling the words in the same order they were displayed (Gross & Rebok, 2011), can observed directly. In the present study, the Zoom recordings could be reviewed and coded for evidence of these observable objective strategies.

**Goal-Setting and Feedback May Help Maintain Task Commitment Over Time**

Across the trials, task commitment over trials declined for participants who did not set goals or receive feedback yet was maintained for those who did set goals and receive feedback, which is the most interesting finding of the present research. This finding suggests that the goal-setting and feedback manipulation led to maintained task commitment over time as the difficulty in the memory test increased. Given that goal setting theory proposes that the addition of feedback and goals could enhance motivation and effort towards a particular goal, increased task commitment could, eventually, lead to better performance (Locke & Latham, 2013). Theoretically, the relatively superior task commitment associated with the goal-setting and feedback manipulation could lead to higher motivation to perform better on a task, persistent effort (even when challenged), and potentially better memory performance over a longer time.

One alternative explanation could be that the maintained – instead of reduced – task commitment was an artifact of experimenter expectancy. The study design did not permit
blinding of research assistants to the experimental conditions, and the task commitment survey questions were read aloud by the research assistants who recorded participants’ oral responses. Follow-up research might test this by presenting the goal-setting and feedback manipulation via computer instead of the researcher, or having participants note their responses to the task commitment survey privately (e.g., on paper and pencil) rather than reporting out loud. Although the survey measure for task commitment used in this research is reliable and valid (Klein et al., 2014), this assessment is also limited because it is a self-report measure. However, given that task commitment is a psychological state, self-report measures of task commitment is necessary to determine commitment to a specific task (Klein et al., 2012). Future research could also assess task commitment by asking participants if they would be willing to complete additional memory tests (e.g., *would you like to keep going*) or to try more difficult or challenging level of the memory tests.

**Impact of Online Administration**

Given the social distancing requirements in place during data collection, all study procedures were administered online via Zoom. For memory performance, having the procedures administered online could have influenced the way participants performed. For example, as only 81% of participants had their video enabled during the session, it is unclear how they studied the words. Even for those who did have their video enabled, it is still unclear what factors they had present in their environment to determine if these factors influenced their performance. This serves as a limitation since the research assistant was not fully aware of what the participant was doing in their home environment during each session. However, past research has successfully administered list recall tasks remotely. For example, the Brief Test of Adult Cognition (BTACT) is a cognitive measure administered over the phone where words are
presented orally in a specific order (Lachman, Agrigoroaei, Tun, & Weaver, 2014).

Additionally, for the present research, all the to-be-learned words were shown on a computer screen at once to maximize the ability to use the strategies taught in the strategy instruction video. Previous research has used the presentation of stimuli to test participants' memory performance and found that the presentation of stimuli on a computer screen can improve memory performance (Hinault et al., 2017).

During the session, participants reported their responses for strategy use and task commitment for both surveys out loud. Participants reporting which strategies they used and their level of task commitment out loud to the research assistant could have introduced an experimenter expectancy effect. This serves as a potential limitation due to technological issues impacting participants' understanding of how to complete the memory tasks and surveys. However, quality control measures were in place for research assistants to follow (e.g., making sure there was adequate sound), and weekly lab meetings discussed quality assurance of the sessions ran. Jordano and Touron (2018) suggest that using think-aloud protocols where participants verbalize their thoughts while completing a cognitive task can influence self-regulation of performance. Future research could administer the entire session via computer where participants report their strategy use and task commitment in private rather than to a research assistant. Additionally, scoring the list recall task and feedback can be administered via computer to reduce the risk of biases or experimenter expectancy effect and ultimately increase the validity of our results.
Limitations and Future Research

Due to feasibility of this project, we recruited participants only from the researchers’ university. Therefore, we may not be able to generalize the results to those who are not university students. However, the purpose of this research was examined between groups effects and thus internal validity, rather than generalization, was a primary consideration.

As described, this study showed tentative evidence for increased strategy use following brief strategy instruction and benefits in terms of maintaining task commitment related to goals and receiving feedback. However, results were inconclusive regarding whether the goal-setting and feedback procedures impacted memory performance. Additionally, even though the study sample size was informed by a power analysis, the analyses may have been underpowered, especially if the effect size in this research was smaller than the students used to conduct the power analysis possibly introducing a Type II error.

In addition to some ideas detailed earlier, such as an additional no instruction comparison group, we have several suggestions for future research that could clarify or extend findings from this study. We recommend that future research examines the amount of training one receives on memory performance. For example, we used a strategy training video that was only five-minutes long and discussed specific strategies to use on a list recall task. A longer training video that discusses improving memory could be more impactful in terms of “setting the stage” for goal-setting and feedback to boost performance. Additionally, future research might evaluate the intervals between testing occasions. The present study used twelve minutes between testing trials, and it is unclear whether a shorter or longer gap between sessions could impact memory performance. Perhaps when using a shorter interval, participants may still remember the exact words from the previous trials.
Similarly, evaluation on the temporal effects of training (e.g., how long do benefits last?) and how goal-setting and feedback impacts performance, might contribute to larger-scale training programs. We also recommend future research examine memory performance with the addition of goal-setting and feedback across a multiday intervention or using different types of memory (e.g., everyday type memory). Adding goal-setting and feedback to a longer intervention could increase motivation and performance as the intervention continues.

**Conclusion**

Although we had a short investigation of the addition of self-regulatory factors within memory training, there are some broader implications from this project. First, after initial implementation of strategy instruction, strategy use increased. This suggests that receiving strategy instruction could impact individuals' use of strategies on tasks after a five minute training video. Implication for strategy instruction is that strategy training could be implemented to attempt to improve performance on tasks. Second, reported task commitment increased across the memory tasks for those who received goal-setting and feedback. The incorporation of using goal-setting and feedback could be beneficial to other programs. For example, goal-setting and feedback can be added to other contexts such as physical exercise or smoking cessation to potentially increase commitment to performing well in those contexts.
REFERENCES


Table 1
*Research Questions and Hypotheses for Primary Outcomes*

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Hypotheses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcomes</td>
<td>Main effect of Occasion</td>
</tr>
<tr>
<td>1. Memory</td>
<td>Hypo 1a. Time 1 &lt; Time 2 &lt; Time 3</td>
</tr>
<tr>
<td></td>
<td>Hypo 1b. StratOnly &lt; Strat+GFB</td>
</tr>
<tr>
<td></td>
<td>Hypo 1c. Time 1: StratOnly = Strat+GFB</td>
</tr>
<tr>
<td></td>
<td>Time 2: StratOnly &lt; Strat+GFB</td>
</tr>
<tr>
<td></td>
<td>Time 3: StratOnly &lt; Strat+GFB</td>
</tr>
<tr>
<td>2. Strategy use</td>
<td>Hypo 2a. Time 1 &lt; Time 2 &lt; Time 3</td>
</tr>
<tr>
<td></td>
<td>Hypo 2b. StratOnly &lt; Strat+GFB</td>
</tr>
<tr>
<td></td>
<td>Exploratory</td>
</tr>
<tr>
<td>3. Task commitment</td>
<td>Exploratory</td>
</tr>
<tr>
<td></td>
<td>Exploratory</td>
</tr>
<tr>
<td></td>
<td>Exploratory</td>
</tr>
</tbody>
</table>
Table 2

*Background and Demographic Information by Condition for Participants*

<table>
<thead>
<tr>
<th></th>
<th>Strat+GFB (n = 24)</th>
<th>StratOnly (n = 23)</th>
<th>Total (N = 47)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>21 (88%)</td>
<td>14 (61%)</td>
<td>35 (75%)</td>
</tr>
<tr>
<td>Class standing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>9 (38%)</td>
<td>10 (44%)</td>
<td>19 (40%)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>9 (21%)</td>
<td>6 (26%)</td>
<td>11 (23%)</td>
</tr>
<tr>
<td>Senior</td>
<td>5 (21%)</td>
<td>2 (9%)</td>
<td>7 (15%)</td>
</tr>
<tr>
<td>Freshman</td>
<td>3 (13%)</td>
<td>4 (17%)</td>
<td>7 (15%)</td>
</tr>
<tr>
<td>Graduate or professional</td>
<td>2 (8%)</td>
<td>1 (4%)</td>
<td>3 (6%)</td>
</tr>
<tr>
<td>Major</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychological sciences a</td>
<td>16 (67%)</td>
<td>9 (39%)</td>
<td>25 (53%)</td>
</tr>
<tr>
<td>Biological sciences b</td>
<td>5 (21%)</td>
<td>5 (22%)</td>
<td>10 (21%)</td>
</tr>
<tr>
<td>Pre-professional c</td>
<td>2 (8%)</td>
<td>6 (26%)</td>
<td>8 (17%)</td>
</tr>
<tr>
<td>Other d</td>
<td>3 (13%)</td>
<td>3 (13%)</td>
<td>6 (12%)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>10 (42%)</td>
<td>10 (44%)</td>
<td>20 (43%)</td>
</tr>
<tr>
<td>White</td>
<td>11 (46%)</td>
<td>5 (22%)</td>
<td>16 (34%)</td>
</tr>
<tr>
<td>Black or African American</td>
<td>2 (8%)</td>
<td>2 (9%)</td>
<td>2 (9%)</td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander</td>
<td>1 (4%)</td>
<td>1 (4%)</td>
<td>2 (4%)</td>
</tr>
<tr>
<td>Other</td>
<td>2 (8%)</td>
<td>6 (26%)</td>
<td>8 (17%)</td>
</tr>
<tr>
<td>American Indian or Alaska Native</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Employed full or part time</td>
<td>7 (30%)</td>
<td>8 (35%)</td>
<td>15 (32%)</td>
</tr>
<tr>
<td>Sleep</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hours of sleep during previous night</td>
<td>6.80 (1.30)</td>
<td>6.30 (2.60)</td>
<td>6.53 (2.00)</td>
</tr>
<tr>
<td>Quality of sleep during previous night (1-10)</td>
<td>6.80 (1.80)</td>
<td>6.90 (2.41)</td>
<td>7.00 (2.10)</td>
</tr>
<tr>
<td>GPA</td>
<td>3.30 (.41)</td>
<td>3.40 (.43)</td>
<td>3.34 (.42)</td>
</tr>
<tr>
<td>Metamemory in Adulthood (1-5)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Achievement</td>
<td>3.80 (.35)</td>
<td>3.83 (.40)</td>
<td>3.82 (.37)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>3.10 (.46)</td>
<td>3.20 (.58)</td>
<td>3.14 (.51)</td>
</tr>
<tr>
<td>Capacity</td>
<td>3.40 (.42)</td>
<td>3.30 (.53)</td>
<td>3.34 (.48)</td>
</tr>
<tr>
<td>Locus</td>
<td>3.90 (.37)</td>
<td>3.73 (.54)</td>
<td>3.80 (.46)</td>
</tr>
<tr>
<td>Strategy</td>
<td>3.70 (.50)</td>
<td>3.70 (.44)</td>
<td>3.70 (.46)</td>
</tr>
<tr>
<td>Growth Fixed Mindset (1-6)</td>
<td>4.14 (.39)</td>
<td>4.04 (.42)</td>
<td>4.10 (.40)</td>
</tr>
</tbody>
</table>

*Note.* For continuous variables, means (standard deviations) are reported. For categorical variables, counts (percentages) are reported. aBiological science majors consisted of biology, biochemistry, and engineering physics. bPre-professional majors consisted of pre-dentistry and pre-pharmacy. cPsychological sciences consisted of psychology and behavioral psychology. dOther majors consisted of diversity and education, economics, health, exercise, and sports science, media x, and political sciences.
### Table 3
Procedure Overview for Administration of Testing Session

<table>
<thead>
<tr>
<th></th>
<th>Est. time</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Set-up</strong></td>
<td>7 min.</td>
<td>*Confirmation of adequate audio and video set up for research activities (e.g., viewing word stimuli, hearing instructions; 3 min.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>*Informed consent form (4 min.)</td>
</tr>
<tr>
<td><strong>Time 1</strong></td>
<td>8 min.</td>
<td>*Task commitment (KUT scale; Klein et al., 2014; 1 min.) List recall task (West et al., 2008; 5 min.) *Strategy checklist (West et al., 2009; 2 min.)</td>
</tr>
<tr>
<td><strong>Manipulation 1</strong></td>
<td>5 min.</td>
<td><strong>Strat+GFB</strong> Goal-setting and feedback (2 min.) Continued to strategy instruction video</td>
</tr>
<tr>
<td><strong>Strategy Instruction</strong></td>
<td>6 min.</td>
<td>Strategy instruction video (Created for this study; 6 min.) followed by survey administration (3 min.)</td>
</tr>
<tr>
<td><strong>Time 2</strong></td>
<td>9 min.</td>
<td>*Task commitment (KUT scale; Klein et al., 2014; 1 min.) List recall task (West et al., 2008; 6 min.) *Strategy checklist (West et al., 2009; 2 min.)</td>
</tr>
<tr>
<td><strong>Manipulation 2</strong></td>
<td>10 min.</td>
<td><strong>Strat+GFB</strong> Goal-setting and feedback (2 min.) followed by survey administration (8 min.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>StratOnly</strong> Survey administration (10 min.)</td>
</tr>
<tr>
<td><strong>Time 3</strong></td>
<td>11 min.</td>
<td>*Task commitment (KUT scale; Klein et al., 2014; 2 min.) List recall task (West et al., 2001; 7 min.) *Strategy checklist (West et al., 2009; 2 min.)</td>
</tr>
<tr>
<td><strong>Conclusion</strong></td>
<td>4 min.</td>
<td>*Goal attainment (West et al., 2009; 1 min.) Return to survey administration or self-completion of surveys Debriefing (3 min.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total time: 60 min.</td>
</tr>
</tbody>
</table>

*Note. KUT = Klein et al. Unidimensional Target Neutral Commitment Measure. “Survey administration” includes the following measurements that were read out loud by the research assistant: Memory in Adulthood (MIA; Dixon, Hultsch, & Hertzog, 1988), Achievement Goal Inventory (Grant & Dweck, 2003), Growth Fixed Mindset (Dweck, 2006), State anxiety (Abrams et al., 2006), and Goal Attainment (West et al., 2009). Self-completion of surveys occurred after all the testing occasions had occurred and after the survey administration was completed: Demographics survey (created for this study), Goal Disengagement and Reengagement Scale (Worsch et al., 2003), and the General Memory Evaluation (West, Dark-Freudeman, & Bagwell, 2009). *Denotes measures that were read out loud by research assistants.*
Table 4
*Intercorrelations, Means, and Standard Deviations for Number of Correctly Recalled Words*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. List recall time 1</td>
<td>-</td>
<td>.71**</td>
<td>.50*</td>
<td>9.80</td>
<td>2.10</td>
</tr>
<tr>
<td>2. List recall time 2</td>
<td>.85**</td>
<td>-</td>
<td>.85**</td>
<td>16.30</td>
<td>4.73</td>
</tr>
<tr>
<td>3. List recall time 3</td>
<td>.73**</td>
<td>.80**</td>
<td>-</td>
<td>23.30</td>
<td>7.41</td>
</tr>
<tr>
<td><em>M</em></td>
<td>10.60</td>
<td>16.80</td>
<td>25.35</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>SD</em></td>
<td>2.90</td>
<td>5.54</td>
<td>8.81</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note. *Intercorrelations for the Strat+GFB condition are presented above the diagonal line, and intercorrelations for the StratOnly condition are presented below the diagonal. Means and standard deviations for the Strat+GFB condition are presented in the vertical columns and means and standard deviations for the StratOnly conditions are presented in the horizontal rows. Scores represent the number of correctly recalled words, out of 15 at Time 1 = 15, Time 2 = 30, Time 3 = 45. **p < .01, *p < .05.*
Table 5
*Intercorrelations, Means, and Standard Deviations for Strategy Use*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Strategy use at 1</td>
<td></td>
<td>.62**</td>
<td>.35</td>
<td>4.42</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>.71**</td>
<td>-</td>
<td>.77**</td>
<td>4.80</td>
<td>1.82</td>
</tr>
<tr>
<td>3. Strategy use at 3</td>
<td>.50*</td>
<td>.35</td>
<td>-</td>
<td>4.80</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td>4.00</td>
<td>5.21</td>
<td>5.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.21</td>
<td>1.81</td>
<td>1.90</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Intercorrelations for the Strat+GFB condition are presented above the diagonal line, and intercorrelations for the StratOnly condition are presented below the diagonal. Means and standard deviations for the Strat+GFB condition are presented in the vertical columns and means and standard deviations for the StratOnly conditions are presented in the horizontal rows. Scores represent strategies used at each time measurement. **p < 0.01, * p < 0.05
Table 6
*Intercorrelations, Means, and Standard Deviations for Task Commitment*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Task commitment at time 1</td>
<td>-</td>
<td>.97**</td>
<td>.93**</td>
<td>5.75</td>
<td>1.10</td>
</tr>
<tr>
<td>2. Task commitment at time 2</td>
<td>.92**</td>
<td>-</td>
<td>.96**</td>
<td>5.95</td>
<td>1.01</td>
</tr>
<tr>
<td>3. Task commitment at time 3</td>
<td>.93**</td>
<td>.95**</td>
<td>-</td>
<td>6.00</td>
<td>1.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>M</td>
<td>5.71</td>
<td>5.86</td>
<td>5.67</td>
</tr>
<tr>
<td>SD</td>
<td>0.91</td>
<td>0.84</td>
<td>1.06</td>
</tr>
</tbody>
</table>

Note. Intercorrelations for the STRAT+GFB condition are presented above the diagonal line, and intercorrelations for the StratOnly conditions are presented below the diagonal. Means and standard deviations for the STRAT+GFB condition are presented in the vertical columns and means and standard deviations for the StratOnly conditions are presented in the horizontal rows. Scores represent commitment to the memory task. Higher scores indicate a greater commitment to the task. **p < 0.01.
Figure 1. Power analysis for $3 \times 2$ mixed factorial repeated measures ANOVA
Power analysis conducted in G*Power (version 3.1.9.7; Faul et al., 2007) for $F$ family test: repeated measures, within-between interaction conducted. Number of groups = 2. Number of measurements = 3. Correlations among repeated measures = 0.8. Nonsphericity = 1. $\alpha$ err prob = 0.05.
Figure 2. Percentage of Correctly Recalled Words by Time and Condition. Error bars depict 95% CI.
Figure 3. Number of correctly recalled items across three trials for both Strat+GFB and StratOnly groups. List 1 consisted of 15 items. List 2 consisted of 30 items. List 3 consisted of 45 items. Error bars depict 95% CI.
Figure 4. Strategy use by time and condition. Error bars depict 95% CI.
Figure 5. Task commitment by time and condition. Error bars depict 95% CI.
APPENDIX C: STIMULI

Rules for list items:
1. The items in the list cannot have more than two items from the same category consecutively within each row and column.
2. All items are in Times New Roman 16pt font and in all caps
3. Items in the list cannot be in the same row, column, or cell throughout level 1, 2, or 3
4. New and old items must be evenly dispersed through the chart
   a. For list 2, the top half (first five words in each column) should be half previously studied words and half new words.
   b. For list 3, each third (top, middle, and bottom sections of columns) each have \( \frac{1}{3} \) words first introduced in list 1 and 2.
   c. Items were pseudorandomized on each level
      i. If items violate above rules after randomization using random.org, items were swapped to follow rules
<table>
<thead>
<tr>
<th>Meats:</th>
<th>Fruits:</th>
<th>Nuts:</th>
<th>Office supplies:</th>
<th>Toiletries:</th>
<th>Breakfast:</th>
</tr>
</thead>
<tbody>
<tr>
<td>HONEY HAM</td>
<td>BANANAS</td>
<td>SALTED PEANUTS</td>
<td>MARKER</td>
<td>DEODORANT</td>
<td>PANCAKES</td>
</tr>
<tr>
<td>BOLOGNA</td>
<td>WATERMELON</td>
<td>WALNUTS</td>
<td>STAPLER</td>
<td>SHAVING CREAM</td>
<td>OATMEAL</td>
</tr>
<tr>
<td>TURKEY</td>
<td>GRAPES</td>
<td>CASHEWS</td>
<td>FOLDER</td>
<td>HAIR LOTION</td>
<td>WAFFLES</td>
</tr>
<tr>
<td>ROAST BEEF</td>
<td>APPLES</td>
<td>ALMONDS</td>
<td>PENCILS</td>
<td>AFTERS</td>
<td>MUFFIN</td>
</tr>
<tr>
<td>SLICED HAM</td>
<td>PEACHES</td>
<td>PECANS</td>
<td>PAPER CLIPS</td>
<td>HAIR</td>
<td>BISCUIT</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vegetables</th>
<th>Dairy</th>
<th>Snacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>BROCCOLI</td>
<td>BUTTER</td>
<td>POPCORN</td>
</tr>
<tr>
<td>CAULIFLOWER</td>
<td>WHIPPED CREAM</td>
<td>CORN CHIPS</td>
</tr>
<tr>
<td>TOMATOES</td>
<td>MARGARINE</td>
<td>POTATO CHIPS</td>
</tr>
<tr>
<td>CARROTS</td>
<td>YOGURT</td>
<td>PRETZELS</td>
</tr>
<tr>
<td>CUCUMBERS</td>
<td>SOUR CREAM</td>
<td>CHEESE CURLS</td>
</tr>
</tbody>
</table>
Level 1 List:

- BANANAS
- WATERMELON
- GRAPES
- APPLES
- PEACHES
- HONEY HAM
- BOLOGNA
- TURKEY
- ROAST BEEF
- SLICED HAM
- PANCAKES
- WAFFLES
- MUFFIN
- BISCUIT
- OATMEAL

Randomized Level 1 List:

<table>
<thead>
<tr>
<th>SLICED HAM</th>
<th>APPLES</th>
<th>BANANAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WAFFLES</td>
<td>TURKEY</td>
<td>HONEY HAM</td>
</tr>
<tr>
<td>ROAST BEEF</td>
<td>BOLOGNA</td>
<td>PANCAKES</td>
</tr>
<tr>
<td>PEACHES</td>
<td>BISCUIT</td>
<td>GRAPES</td>
</tr>
<tr>
<td>OATMEAL</td>
<td>WATERMELON</td>
<td>MUFFIN</td>
</tr>
</tbody>
</table>

Example of Level 1 stimuli in PowerPoint:

Level 2 List:

- BANANAS
- WATERMELON
- GRAPES
- APPLES
- PEACHES
- HONEY HAM
- BOLOGNA
- TURKEY
- ROAST BEEF
- SLICED HAM
- PANCAKES
- WAFFLES
- MUFFIN
- BISCUIT
- MARKER
- STAPLER
- FOLDER
<table>
<thead>
<tr>
<th>PENCILS</th>
<th>CASHEWS</th>
<th>SHAVING CREAM</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAPER CLIPS</td>
<td>ALMONDS</td>
<td>HAND LOTION</td>
</tr>
<tr>
<td>SALTED PEANUTS</td>
<td>PECANS</td>
<td>AFTERSHAVE</td>
</tr>
<tr>
<td>WALNUTS</td>
<td>DEODORANT</td>
<td>LIP BALM</td>
</tr>
</tbody>
</table>

Randomized Level 2:

<table>
<thead>
<tr>
<th>MUFFIN</th>
<th>CASHEWS</th>
<th>PANCAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALNUTS</td>
<td>WAFFLES</td>
<td>ROAST BEEF</td>
</tr>
<tr>
<td>BOLOGNA</td>
<td>SHAVING CREAM</td>
<td>DEODORANT</td>
</tr>
<tr>
<td>ALMONDS</td>
<td>LIP BALM</td>
<td>WATERMELON</td>
</tr>
<tr>
<td>TURKEY</td>
<td>FOLDER</td>
<td>GRAPES</td>
</tr>
<tr>
<td>AFTERSHAVE</td>
<td>STAPLER</td>
<td>SLICED HAM</td>
</tr>
<tr>
<td>PECANS</td>
<td>PEACHES</td>
<td>PAPER CLIPS</td>
</tr>
<tr>
<td>APPLES</td>
<td>BANANAS</td>
<td>PENCILS</td>
</tr>
<tr>
<td>BISCUIT</td>
<td>SALTED PEANUTS</td>
<td>HONEY HAM</td>
</tr>
<tr>
<td>HAND LOTION</td>
<td>OATMEAL</td>
<td>MARKER</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MUFFIN</th>
<th>CASHEWS</th>
<th>SALTED PEANUTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>WALNUT</td>
<td>WAFFLES</td>
<td>ROAST BEEF</td>
</tr>
<tr>
<td>BOLOGNA</td>
<td>OATMEAL</td>
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<td>ALMONDS</td>
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<td>GRAPES</td>
</tr>
<tr>
<td>AFTERSHAVE</td>
<td>STAPLER</td>
<td>SLICED HAM</td>
</tr>
<tr>
<td>PECANS</td>
<td>PANCAKES</td>
<td>PAPER CLIPS</td>
</tr>
<tr>
<td>APPLES</td>
<td>BANANAS</td>
<td>PENCILS</td>
</tr>
<tr>
<td>BISCUIT</td>
<td>FOLDER</td>
<td>HONEY HAM</td>
</tr>
<tr>
<td>HAND LOTION</td>
<td>SHAVING CREAM</td>
<td>MARKER</td>
</tr>
</tbody>
</table>
Example of Level 2 stimuli in PowerPoint:

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>MUFFIN</td>
<td>CASHEWS</td>
<td>SALTED PEANUTS</td>
</tr>
<tr>
<td>WALNUT</td>
<td>WAFFLES</td>
<td>ROAST BEEF</td>
</tr>
<tr>
<td>BOLOGNA</td>
<td>OATMEAL</td>
<td>DEODORANT</td>
</tr>
<tr>
<td>ALMONDS</td>
<td>LIP BALM</td>
<td>WATERMELON</td>
</tr>
<tr>
<td>TURKEY</td>
<td>PEACHES</td>
<td>GRAPES</td>
</tr>
<tr>
<td>AFTERSHAVE</td>
<td>STAPLER</td>
<td>SLICED HAM</td>
</tr>
<tr>
<td>PECANS</td>
<td>PANCAKES</td>
<td>PAPER CLIPS</td>
</tr>
<tr>
<td>APPLES</td>
<td>BANANAS</td>
<td>PENCILS</td>
</tr>
<tr>
<td>BISCUIT</td>
<td>FOLDER</td>
<td>HONEY HAM</td>
</tr>
<tr>
<td>HAND LOTION</td>
<td>SHAVING CREAM</td>
<td>MARKER</td>
</tr>
</tbody>
</table>

Randomized Level 3 List:

- SHAVING CREAM
- BANANAS
- DEODORANT
- BISCUIT
- SLICED HAM
- WAFFLES
- HAND LOTION
- CHEESE CURLS
- WALNUTS
- PENCILS
- WHIPPED CREAM
- POPCORN
- PEACHES
- MARGARINE
- BOLOGNA
- AFTERSHAVE

- HONEY HAM
- ROAST BEEF
- SALTED PEANUTS
- WALMELON
- CASHEWS
- MUFFIN
- CORN CHIPS
- SOUR CREAM
- ALMONDS
- STAPLER
- POTATO CHIPS
- BUTTER
- APPLES
- OATMEAL

- PRETZELS
- CAULIFLOWER
- FOLDER
- MARKER
- TURKEY
- YOGURT
- BROCCOLI
- LIP BALM
- PECANS
- PANCAKES
- PAPER CLIPS
- TOMATOES
- GRAPES
- CARROTS
# Level 3 List:

<table>
<thead>
<tr>
<th>BANANAS</th>
<th>MARKER</th>
<th>BROCCOLI</th>
</tr>
</thead>
<tbody>
<tr>
<td>WATERMELON</td>
<td>STAPLER</td>
<td>CAULIFLOWER</td>
</tr>
<tr>
<td>GRAPES</td>
<td>FOLDER</td>
<td>TOMATOES</td>
</tr>
<tr>
<td>APPLES</td>
<td>PENCILS</td>
<td>CARROTS</td>
</tr>
<tr>
<td>PEACHES</td>
<td>PAPER CLIPS</td>
<td>CUCUMBERS</td>
</tr>
<tr>
<td>HONEY HAM</td>
<td>SALTED PEANUTS</td>
<td>BUTTER</td>
</tr>
<tr>
<td>BOLOGNA</td>
<td>WALNUTS</td>
<td>WHIPPED CREAM</td>
</tr>
<tr>
<td>TURKEY</td>
<td>CASHEWS</td>
<td>MARGARINE</td>
</tr>
<tr>
<td>ROAST BEEF</td>
<td>ALMONDS</td>
<td>YOGURT</td>
</tr>
<tr>
<td>SLICED HAM</td>
<td>PECANS</td>
<td>SOUR CREAM</td>
</tr>
<tr>
<td>PANCAKES</td>
<td>DEODORANT</td>
<td>POPCORN</td>
</tr>
<tr>
<td>OATMEAL</td>
<td>SHAVING CREAM</td>
<td>CORN CHIPS</td>
</tr>
<tr>
<td>WAFFLES</td>
<td>HAND LOTION</td>
<td>POTATO CHIPS</td>
</tr>
<tr>
<td>MUFFIN</td>
<td>AFTERSHAVE</td>
<td>PRETZELS</td>
</tr>
<tr>
<td>BISCUIT</td>
<td>LIP BALM</td>
<td>CHEESE CURLS</td>
</tr>
</tbody>
</table>

**Shopping List:**

- **BANANAS**
- **WATERMELON**
- **GRAPES**
- **APPLES**
- **PEACHES**
- **HONEY HAM**
- **BOLOGNA**
- **TURKEY**
- **ROAST BEEF**
- **SLICED HAM**
- **PANCAKES**
- **OATMEAL**
- **WAFFLES**
- **MUFFIN**
- **BISCUIT**

**Office Supplies:**

- **MARKER**
- **STAPLER**
- **FOLDER**
- **PENCILS**
- **PAPER CLIPS**
- **SALTED PEANUTS**
- **WALNUTS**
- **CASHEWS**
- **ALMONDS**
- **PECANS**
- **DEODORANT**
- **SHAVING CREAM**
- **HAND LOTION**
- **LIP BALM**
- **PRETZELS**
- **BROCCOLI**
- **CAULIFLOWER**
- **TOMATOES**
- **SOUR CREAM**
- **POPcorn**
- **CORN CHIPS**
- **LIP BALM**
- **PECANS**
- **PANCAKES**
- **PAPER CLIPS**
- **FOLDER**
- **BUTTER**
- **GRAPEs**
- **APPLES**
- **CARROTS**
- **BOLOGNA**
- **OATMEAL**
- **AFTERSHAVE**
Example of Level 3 stimuli in PowerPoint:

<table>
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<th>Level 3</th>
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<tbody>
<tr>
<td>SHAVING CREAM</td>
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</tr>
<tr>
<td>BANANAS</td>
<td>ROAST BEEF</td>
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<tr>
<td>BISCUIT</td>
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<td>MARKER</td>
</tr>
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<td>WHIPPED CREAM</td>
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</tr>
<tr>
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<tr>
<td>POPCORN</td>
<td>POTATO CHIPS</td>
<td>FOLDER</td>
</tr>
<tr>
<td>PEACHES</td>
<td>BUTTER</td>
<td>GRAPES</td>
</tr>
<tr>
<td>MARGARINE</td>
<td>APPLES</td>
<td>CARROTS</td>
</tr>
<tr>
<td>BOLOGNA</td>
<td>OATMEAL</td>
<td>AFTERSHAVE</td>
</tr>
</tbody>
</table>
APPENDIX D: DEMOGRAPHICS QUESTIONNAIRE

1) Date of birth: Month _______ Day _______ Year _______

2) Age: __________

3) Sex (check one): Male _____ Female _____

4) How would you identify your sexual orientation? Please check the one best descriptor.
   a. Heterosexual
   b. Bisexual
   c. Lesbian or gay
   d. Asexual
   e. Other (please describe): ________________

5) Race (check one):
   ______ Caucasian ______ African American
   ______ Asian ______ Other: __________________________
   ______ American Indian/ Native American _______ Middle Eastern
   ______ Pacific Islander _______ Biracial/ Multiracial (please describe): _______

6) Ethnicity (check one): _______ Hispanic/ Latinx _______ non-Hispanic/ Latinx

7) Marital Status (check one):
   Single_____ Married______ Separated_____ Divorced_____ Widowed_____

8) Please check the highest level of education you have completed:

   Grade school / High school:
   
   1st 2nd 3rd 4th 5th 6th 7th 8th 9th 10th 11th 12th

   Trade, Business or Technical School: 1 yr 2 yr 3 yr 4 yr
9) Are you a student? _______ Yes, full time; _______ Yes, part time; _______ No

10) What is your student status? ______ In-state student ______ Out of state student
    _______ Study abroad student _______ International student

11) Are you currently employed? _______ Full time employment
    _______ Part time employment
    _______ Unemployed

12) Are you a first-generation college student? (check one) _____ yes ______ no

13) How many children do you have? ______________

14) Please choose the option that best describes the environment in which you grew up:
    _____ rural _____ urban _____ suburban

15) What is your Religious Affiliation? _____ Catholic _____Christian _______ Hindu
    _____ Muslim _____ Jewish _______ Buddhist _____ Islamic _____ Agnostic
    _____ Atheist _____ Other

16) What is your Major? _______________

17) Compared to other people my age, I believe my health to be: (select one)
    
    Very Good    Good    Moderately Good    Moderately Poor    Poor    Very Poor

    1    2    3    4    5    6
APPENDIX E: INFORMED CONSENT FORM

INFORMED CONSENT

RESEARCH PARTICIPANT’S CONSENT TO PARTICIPATE IN RESEARCH

Your consent is being sought to participate in a research study, and your participation in entirely voluntary. Please read the information on this informed consent screen carefully before you decide to participate in this study.

Research Title: Learning Strategies Study

Principal Investigator: Mercedes Ball, B.S. Department of Psychology University of the Pacific (209) 946-3143 aginglab@pacific.edu

Faculty Advisor: Carla M. Strickland-Hughes, Ph.D. Department of Psychology University of the Pacific (209) 946-7315 cstricklandhughes@pacific.edu

Purpose of Study: The purpose of this study is to evaluate the benefits of using strategies.

What you will be asked to do in the study: During a single Zoom interview, you will be asked to complete three memory activities and to answer survey questions. The survey questions will ask about your background, your opinions, and your response to the memory activities. You will also be asked to watch a video about how to use memory strategies.

Time required: We expect the entire Zoom interview will take about one hour for most participants.

Risks and Benefits: We do not anticipate any risks to you other than those in everyday life. Some people may feel mild anxiety when completing memory activities. This is normal. If you feel distressed, you may contact the University of the Pacific’s Counseling and Psychological Services by calling 209-946-2315 extension 2 or visiting https://www.pacific.edu/campus-life/student-services/counseling-and-psychological-services.html. You may also contact the San Joaquin County Crisis Clinic on their free 24-hour hotline at (209) 468-8683.

There is a minimal risk of loss of confidentiality, which may happen if the research assistants working on this research project potentially reveal the link of the connection between the identification number and your name. However, all research assistants are trained in research ethics and confidentiality and will be carefully instructed to not reveal the connection between the identification number and your name or to tell anyone that you participated in the study.

One potential benefit of participating in the study is that you might learn about memory strategies.

Compensation: You can pick one of three types of compensation for participating in this study:

- **Option 1:** You will receive two SONA credits. Some instructors provide extra credit in some classes for completing research projects. SONA credits count for extra credit in those classes
at the rate indicated on the course syllabus for the class(es) for which you would like to assign credit.

- **Option 2:** You will receive one entry into a raffle for a $20 Amazon egift card. One out of four winning raffle entries will be selected at random within one month of the last interview completed for the study.
- **Option 3:** You will receive one $5 Amazon egift card. Gift cards will be distributed within one month of the last interview completed for the study.

**PARTICIPANT’S RIGHTS**

**Confidentiality:** Your identity will be kept as confidential as possible. No private, identifiable information will be collected in this study. You have been assigned a unique code number. The list connecting your name to this number will be sealed and kept in a locked file. The data from this study will be de-identified so that your identity cannot be linked to the data. The de-identified data will be stored on a hard drive locked within the Principal Investigator’s lab space indefinitely to be used for research purposes only. Data will not be used for commercial profit. If the results of this research are published or presented at scientific meetings, your identity will in no way be disclosed. Furthermore, your individual answers will not be analyzed but will only be included in group data.

With your permission, we will record your Zoom interview to the cloud storage for our University of the Pacific Zoom account. We will use the recordings for quality control and data coding. We will not share access to the recording of your video with any person who is not approved study personnel or has not completed training in ethical research practices. The recording of your interview will be deleted as soon as the information from the interviews have been transcribed.

There is a minimal risk that security of any online data may be breached, but since (1) no identifying information will be collected, (2) the online host uses several layers of encryption and firewalls, and (3) your data will be removed from the server soon after you complete the study, it is highly unlikely that a security breach of the online data will result in any adverse consequence for you. Any researchers who will have access to your data are trained in ethical data collection and pose minimal risk for any breach of confidentiality.

**Voluntary participation:** Your participation in this study is completely voluntary. There is no penalty for not participating. You also do not have to answer any question that you do not want to answer.

**Right to withdraw from the study:** You have the right to withdraw from the study at any time without consequence.

**CONTACT INFORMATION**

**Whom to contact if you have questions about the study:** If you have any questions, concerns or complaints about this research, its procedures, risks and benefits, you may contact the Principal Investigator at (209) 946-3143 or m_ball3@u.pacific.edu or the Faculty Advisor at (209) 946-7315 or cstricklandhughes@pacific.edu.

**Independent Contact:** If you are not satisfied with how this study is being conducted, or if you have any concerns, complaints, or general questions about the research or your rights as a participant, please contact the Office of Research & Sponsored Programs to speak to someone independent of the research team at (209) 946-3903 or irb@pacific.edu.
AGREEMENT

By selecting “Yes, I agree”, I indicate that:

• I have read and understand the information provided above
• I voluntarily participate in the research study
• I give permission for the Zoom interview to be recorded
• I understand that I may withdraw my consent and discontinue participation at any time without penalty or loss of benefits to which I am otherwise entitled
• I can print or save a copy for my record
• I am not waiving any legal claims, rights, or remedies.
**APPENDIX F: RESEARCH ASSISTANT MANUAL FOR EXPERIMENTAL SESSIONS**

**Ps arrival**

**Greet P**

> When P enters, say hello and introduce yourself. Ask how they are doing.

*First, I want to make sure that we can hear each other.*

**Troubleshoot as needed so you can hear each other**

<table>
<thead>
<tr>
<th><strong>IF “NO”:</strong></th>
<th><em>I will adjust my microphone.</em></th>
</tr>
</thead>
<tbody>
<tr>
<td>In Zoom, click the upright arrow next to microphone in the left-hand corner of the bottom panel in the zoom meeting. Click “Audio Settings”. Move the toggle on the Output Volume bar to the right.</td>
<td>Complete basic troubleshooting. Continue when you can hear each other.</td>
</tr>
</tbody>
</table>

---

**Minimizing distractions**

**Address common distractions:**

- Cell phone off
- TV/music off
- Pets
- Other people

| **We want you to be able to do your best during the interview. That means you should be in a quiet, private place without distractions.** |
| **Would you please silence your cell phone and close any programs on your computer that might “alert” or distract you during the session?** |
| Wait until P silences cell phone and closes programs. |

*Thank you. Are there any other noises that might distract you like TV or music playing?*

| **IF “YES”: Would you mind turning off the TV/music during this interview?** |
| Wait until addressed. |

*Do you have a pet nearby that might distract you?*

| **IF “YES”: Would it be possible to put your pet in another room during the interview?** |
| Wait until addressed. |

*Are you in a quiet, private place? Are there other people at home who might interrupt us?*
**If “YES”:** Is there another location that might be more private? – or –

Please ask the other person/people at home not to interrupt you.

**If P cannot adequately minimize distractions:**

*Unfortunately, this does not seem like the best time for your interview. We want you to be able to do your best, but that means having minimal distractions. Would you like to reschedule for a better time?*

Find out a) the best way to contact P to reschedule and b) different times they are available. Send this information to Mercedes at aginglab@pacific.edu asking her to reschedule the P. Tell the P that the Principal Investigator will contact them in the next day or two to reschedule. Give them our contact information (aginglab@pacific.edu, 209-946-3143 in case they have questions for us.

---

**Introduction and informed consent script**

*Thank you for signing up to participate in this study. Today I will be reading instructions and questions word for word. This might be awkward at times, but it will help us make sure to treat everyone the same way. Let’s start the Learning Strategies Study.*

**Click ➔ to continue.** The Informed Consent should be presented on the screen.

*Before we start, I need to make sure that you understand what is involved in today’s session and consent to participate.*

In the Zoom chat: **1) Paste the link** to the “shareable informed consent form” from the URLs file and **2) attach the PDF** of the informed consent.

*Here is the informed consent form. The form explains the study. You can download it from the Zoom chat. Please save it so that you will have information about the purpose of the study and who to contact if you have questions or concerns.*

*The session will take about one hour. We will ask you to complete memory activities and to answer questions about your background and your opinions. Sometimes I will ask you questions directly, and other times you will answer questions on your computer. I will also show you a video about memory strategies. A few of the activities are timed, so you might hear my timer. We might have to wait on the timer before starting some activities.*

*We do not anticipate any risks to you other than those in everyday life.*

*Your participation is completely voluntary. You may withdraw your consent or participation at any time, without consequence. You do not have to answer any questions that you do not wish to answer.*
Your identity will be kept confidential. Any information you provide will be assigned a code number. Only authorized research staff, who are trained in research ethics, will have access to the data and the list linking names and code numbers.

As a small thank you for doing the study, you can pick to get either two SONA credits or an entry for a gift card raffle. One in four entries will win a $20 Amazon gift card. Please review the form and let me know what questions you have.

Answer all questions.

Do you agree to participate in today’s interview?

P must agree to participate for you to continue. Do not continue without agreement. If they agree, select “Yes, I agree” and click → to continue.

If Ps do not agree, click “No, I do not agree.” Read the message to them. Thank them for their time.
End the Zoom call, record your notes, and send an email update to Mercedes and the lab (aginglab@pacific.edu). Include the time and date, and the P’s ID, but NOT their name.

I would like your permission to record this interview. The recording will help us check that we followed the procedures and that we correctly noted your responses. May I record the call?

If P consents, start recording to the cloud.

If P does not consent, do not record. Write in the notes P did not give permission to record.

Participant ID

Continue by reading the questions in LSS Survey to Ps. Record their answers. The first questions will help you create the ID. Write the ID code on every page of the answer packet.

Enter the ID twice in LSS Survey. Click → to continue. Read the instructions text to P.

Adequate video for stimuli

When the “lorem ipsum” text is presented, ask: Can you read this text?

IF “NO”: Complete basic troubleshooting: Zoom in on your browser, ask P to change settings for Zoom (e.g., full screen, adjust windows, change Zoom view, switch device).

Once P can read the words say: Let’s begin. Click → to continue.
Follow instructions in LSS Survey. Read the questions and record P’s responses. When prompted to ask if P has any questions, always answer their questions before continuing.

Return to these instructions for additional notes when you come to the first memory Time.

OVERALL PROCEDURE AND MEMORY TIME ADMINISTRATION

The overall procedure of the interview is outlined below and followed by specific instructions that are NOT on the surveys (e.g., setting timers, giving feedback).

Time #1
- **Task Commitment Questions** (Follow instructions in LSS Survey)
- **Encoding** – 15 words (LSS Survey will show the words for 1 min. 15 sec.)
- **AFTER ENCODING AND BEFORE RECALL SET TIMER FOR 12 MINUTES**
- **Recall** – (LSS Survey will show “Say all the words you remember, in any order” for 2 min.)
- **Strategy Checklist** (Follow instructions in LSS Survey; write “other” strategies verbatim and/or check with P that your typed summary is acceptable.)
- **+STRAT+GFB ONLY:** Give feedback and ask P to set goal

**Strategy Instruction**
- Present sample jazz video (embedded in LSS Survey) to confirm P can hear / see video
- Present the strategy video (embedded in LSS Survey)

**RA Read Aloud Survey**
- Administer questions from the “**RA Read Aloud Survey**” UNTIL 12 MIN. TIMER
- Stop these questions as soon as the timer goes off – do not finish the current question (you can return to it later)

Time #2
- **Task Commitment Questions** (Follow instructions in LSS Survey)
- **Encoding** – 30 words (LSS Survey is programmed to show the words for 1 min. 30 sec.)
- **AFTER ENCODING AND BEFORE RECALL SET TIMER FOR 12 MIN.**
- **Recall** – (LSS Survey will show “Say all the words you remember, in any order” for 3 min.)
- **Strategy Checklist** (Follow instructions in LSS Survey)
- **+STRAT+GFB ONLY:** Give feedback and ask P to set goal

**RA Read Aloud Survey**
- Administer questions from the “**RA Read Aloud Survey**” UNTIL 12 MIN. TIMER
- Stop these questions as soon as the timer goes off (can finish later)
- If you finish all the questions, **wait quietly for the full 12 min.**
Time #3

- **Task Commitment Questions** (Follow instructions in LSS Survey)
- **Encoding** – 45 words (LSS Survey will show the words for 1 min. 45 sec. )
- **AFTER ENCODING AND BEFORE RECALL SET TIMER FOR 12 MIN.**
- **Recall** – (LSS Survey will show “Say all the words you remember, in any order” for 4 min. )
- **Strategy Checklist** (Follow instructions in LSS Survey)
- **+STRAT+GFB ONLY:** Give feedback

**Final Surveys:** Finish “RA Read Aloud” (if needed), then “Participant Self-Complete Survey”

<table>
<thead>
<tr>
<th>TIME 1</th>
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</thead>
</table>

**Encoding for Level 1**

When P indicates they understand the memory activity instructions, click \( \rightarrow \) to continue.

The 15 items will be displayed automatically for 1 minute and 15 seconds. You may set a back-up timer if you want. **Mute yourself during the encoding period.**

**SET THE TIMER FOR 12 MINUTES SO THAT YOU ONLY NEED TO PRESS “START” AFTER ENCODING IS COMPLETE.**

**Recall for Level 1**

When encoding is over, the words will “disappear” and the instructions will say “Say all the words you can, in any order.” **START TIMER FOR 12 MINUTES.**

**Write down the words Ps recalled. WRITE THE WORDS IN THE ORDER OF RECALL, FROM TOP-TO-BOTTOM. Use short-hand (e.g., writing the first couple of letters) to capture the words quickly. Then complete the words at your first chance (e.g., when P stops recalling words but before the time is up).**

**Mute yourself during recall** and do not say anything until the recall time is over (unless P asks you a direct question; if they do, answer it as briefly as possible).

The LSS Survey is programed to present the recall instructions text for 2 minutes. Then, the next instructions (for strategy checklist) will appear. **Unmute** yourself and **continue** reading the instructions and recording P’s answers.
Strategy Checklist 1

On the strategy checklist, you do not need to read all the strategies to P. Instead, read the overall instructions, then have them tell you the numbers of the strategies that they used. Select the check box for each strategy they indicated using.

If P chooses “other”: If their description of the strategy is short or simple, type their strategy verbatim into the text box. Otherwise, summarize the strategy. Read what you typed to the P and confirm they believe it reflects what they did. Adjust as necessary.

Strategy Instruction

Play the “jazz” sample video to make sure P can hear and see the video. Troubleshoot as necessary (e.g., make sure you are sharing computer sound in Zoom; show video full screen). Then, following the instructions on the LSS Survey, present the strategy instruction video.
**STRAT+STRAT+GFB – Level 1 Manipulation**

Count the number of words (minus obvious repetitions) the P listed during Level 1 Recall. Do not worry about being 100% accurate (e.g., checking whether each of the words are exactly matched to the stimuli list). You should pretend to score the responses (and to be impressed). You might silently count the number of words and write notes to seem like you are checking accuracy.

Provide feedback to P. Try to make the feedback sound natural and realistic.

**YOUR FEEDBACK MUST:**

1. Include encouraging words, e.g., “great” or “nice” or “wow.”

2. Indicate about how many words they recalled correctly on the first activity.

3. Indicate the score is “good” or “impressive.”

Here is an example that meets the three criteria:

*Excellent! For the first list activity, you remembered about XXX correctly. That’s pretty good!*

After providing feedback, click → to continue.

Read the goal-setting instructions (from LSS Survey):

*Next time, you will be asked to learn and remember 30 words, including these 15 words plus 15 new words. People typically remember about 10 more words on the next task. What is your goal? How many more words do you want to remember?*

Record the P’s goal 1) directly in LSS survey, 2) on the bottom of the Level 1 Recall page of the answer packet, and 3) on the bottom of the Level 2 Recall page of the answer packet.

As you enter the goal, 1) say something positive about the goal (e.g., “That’s a good goal”) and 2) encourage them (e.g., “I bet you can make that goal”).

**THEN SWITCH TO THE “RA READ ALOUD SURVEY.”**

**CONTINUE IN THE “READ ALOUD SURVEY” UNTIL THE 12 MINUTES IS OVER.**

When the timer goes off (12 minutes after encoding finished / recall began), return to the “LSS Survey” immediately (do not finish answering the current question).
**STRAT-ONLY – Level 1 Manipulation**

In this condition, you do NOT tell P how many words they recalled. You should NOT make ANY remarks about their performance. Instead, from the “LSS Survey” instructions, read:

> Now we will start the next activity. You have just completed the first list activity. The items from the first list activity included 15 words. The second list activity will have 30 words total to remember. The 30 words will include the 15 from the first list activity and 15 new words.

**THEN SWITCH TO THE “RA READ ALOUD SURVEY.”**

**CONTINUE IN THE “READ ALOUD SURVEY” UNTIL THE 12 MINUTES IS OVER.**

When the timer goes off (12 minutes after encoding finished / recall began), return to the “LSS Survey” immediately (do not finish answering the current question.)
CONTINUE HERE FOR BOTH CONDITIONS

Return to the “LSS Survey” after the 12-minute time has finished. Administer Time 2 procedures. When you advance, you will see the Task Commitment Questions. Proceed accordingly.

TIME 2

Encoding for Level 2

After reading instructions for the second memory activity in “LSS Survey”…

<table>
<thead>
<tr>
<th>STRAT+STRAT+GFB</th>
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<tbody>
<tr>
<td><em>Remember, the goal you set for the second list activity was to remember</em> &lt; READ GOAL FROM ANSWER SHEET &gt; <em>more words. You can do it!</em></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STRAT-ONLY</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Again, the 30 words will include the 15 from the first list activity and 15 new words.</em></td>
</tr>
</tbody>
</table>

CONTINUE HERE FOR BOTH CONDITIONS

When P indicates they are ready for the second memory activity, click ➔ to continue.

The 30 items will be displayed automatically for 1 minute and 30 seconds. You may set a back-up timer if you want. **Mute yourself during the encoding period.**

**SET THE TIMER FOR 12 MINUTES SO THAT YOU ONLY NEED TO PRESS “START” AFTER ENCODING IS COMPLETE.**
Recall for Level 2

When encoding is over, the words will “disappear” and the instructions will say “Say all the words you can, in any order. ” **START TIMER FOR 12 MINUTES.**

Write down the words Ps recalled. **WRITE THE WORDS IN THE ORDER OF RECALL, FROM TOP-TO-BOTTOM.** Use short-hand (e.g., writing the first couple of letters) to capture the words quickly. **Then complete the words** at your first chance (e.g., when P stops recalling words but before the time is up).

**Mute yourself during recall** and do not say anything until the recall time is over (unless P asks you a direct question; if they do, answer it as briefly as possible).

The LSS Survey is programmed to present the recall instructions text for **3 minutes**. Then, the next instructions (for strategy checklist) will appear. **Unmute** yourself and **continue** reading the instructions and recording P’s answers.

Strategy Checklist 2

On the strategy checklist, you do not need to read all the strategies to P. Instead, **read the overall instructions**, then have them tell you the numbers of the strategies that they used. **Select the check box for each strategy they indicated using.**

**If P chooses “other”:** If their description of the strategy is short or simple, type their strategy verbatim into the text box. Otherwise, summarize the strategy. Read what you typed to the P and confirm they believe it reflects what they did. Adjust as necessary.

Click ➔ to continue.
Manipulation 2

STRAT+STRAT+GFB – Level 2 Manipulation

Count the number of words (minus obvious repetitions) the P listed during Level 2 Recall. Do not worry about being 100% accurate (e.g., checking whether each of the words are exactly matched to the stimuli list). You should pretend to score the responses (and to be impressed). You might silently count the number of words and write notes to seem like you are checking accuracy.

Provide feedback to P. Try to make the feedback sound natural and realistic.

YOUR FEEDBACK MUST:

1. Include encouraging and positive phrases.

2. Indicate how many words they recalled in total.

3. Indicate how many more words that was than the previous time.

4. In a positively-framed way, compare their performance to their goal.

Here are examples that meet the criteria:

• If did NOT meet goal: You remembered X words this time – that’s Y more than last time. Way to go - that’s close to your goal!

• If MET goal: Awesome - you met your goal! This time you remembered Y more words. That is a total of X words remembered.

• If EXCEEDED goal: This time you remembered Y more words... Wow – that’s even more than your goal! In total, you remembered X words.

After providing feedback, click → to continue.

Read the goal-setting instructions (from LSS Survey). Record the P’s goal 1) directly in LSS survey, 2) on the bottom of the Level 2 Recall page of the answer packet, and 3) on the bottom of the Level 3 Recall page of the answer packet. As you enter the goal, 1) say something positive about the goal (e.g., “That’s a good goal”) and 2) encourage them (e.g., “I bet you can make that goal”).

THEN SWITCH TO THE “RA READ ALOUD SURVEY.”

CONTINUE IN THE “READ ALOUD SURVEY” UNTIL THE 12 MINUTES IS OVER.
When the timer goes off (12 minutes after encoding finished / recall began), return to the “LSS Survey” immediately. If you finish all the questions, wait quietly for the full 12 minutes.
STRAT-ONLY

In this condition, you do NOT tell P how many words they recalled. You should NOT make ANY remarks about their performance. Instead, from the “LSS Survey” instructions, read:

Now we will start the next activity. You have just completed the second list activity. The items from the two list activities included 30 words. The third list activity will have 45 words total to remember. The 45 words will include the 30 from the second list activity and 15 new words. Before we continue to the final list activity, I would like you to complete a few survey questions.

THEN SWITCH TO THE “RA READ ALOUD SURVEY.”

CONTINUE IN THE “READ ALOUD SURVEY” UNTIL THE 12 MINUTES IS OVER. When the timer goes off (12 minutes after encoding finished / recall began), return to the “LSS Survey” immediately. If you finish all the questions, wait quietly for the full 12 minutes.

CONTINUE HERE FOR BOTH CONDITIONS

Survey Administration 2

Continue administering the “RA Read Aloud Survey.” Review the instructions for the current question(s) again, if necessary.

Return to the “LSS Survey” when the 12-minute time (since the end of Level 2 Encoding / start of Level 2 Recall) has finished, but not before. Wait the full 12 minutes before returning to the “LSS Survey,” even if they have finished the question(s) on the “RA Read Aloud Survey.”

The “LSS Survey” should show the Task Commitment Questions again. Proceed accordingly.
Encoding for Level 3

After reading instructions for the third memory activity in “LSS Survey”…

**STRAT+STRAT+GFB**

*Remember, the goal you set for this list activity was to remember < INDICATE GOAL FROM ANSWER SHEET > more words. I know you can do that!*

**STRAT-ONLY**

*Again, the 45 words will include words from the first two list activities and 15 new words.*

**CONTINUE FOR BOTH CONDITIONS**

When P indicates they are ready for the third memory activity, **click → to continue.**

The 45 items will be displayed automatically for 1 minute and 45 seconds. You may set a back-up timer if you want. **Mute yourself during the encoding period.**

**SET THE TIMER FOR 12 MINUTES SO THAT YOU ONLY NEED TO PRESS “START” AFTER ENCODING IS COMPLETE.**

Recall for Level 3

When encoding is over, the words will “disappear” and the instructions will say “Say all the words you can, in any order.” **Write down the words Ps recalled. WRITE THE WORDS IN THE ORDER OF RECALL, FROM TOP-TO-BOTTOM. Use short-hand (e.g., writing the first couple of letters) to capture the words quickly. Then complete the words at your first chance (e.g., when P stops recalling words but before the time is up).**

**Mute yourself during recall** and do not say anything until the recall time is over (unless P asks you a direct question; if they do, answer it as briefly as possible).

The LSS Survey is programed to present the recall instructions text for **4 minutes.** Then, the next instructions (for strategy checklist) will appear. **Unmute** yourself and **continue** reading the instructions and recording P’s answers.
Strategy Checklist 3

On the strategy checklist, you do not need to read all the strategies to P. Instead, read the overall instructions, then have them tell you the numbers of the strategies that they used. Select the check box for each strategy they indicated using.

If P chooses “other”: If their description of the strategy is short or simple, type their strategy verbatim into the text box. Otherwise, summarize the strategy. Read what you typed to the P and confirm they believe it reflects what they did. Adjust as necessary.

Click to continue.

Manipulation 3

STRAT+STRAT+GFB

Count the number of words (minus obvious repetitions) the P listed during Level 3 Recall. Do not worry about being 100% accurate (e.g., checking whether each of the words are exactly matched to the stimuli list). You should pretend to score the responses (and to be impressed). You might silently count the number of words and write notes to seem like you are checking accuracy.

Provide feedback to P. Try to make the feedback sound natural and realistic.

YOUR FEEDBACK MUST:

1. Include encouraging and positive phrases.
2. Indicate how many words they recalled in total.
3. Indicate how many more words that was than the previous.
4. In a positively-framed way, compare their performance to their goal.
5. Not be identical to what you said for the Level 2 Feedback.

Here are examples that meet the criteria:

- If did NOT meet goal: You remembered X words this time – that’s Y more than last time. Way to go - that’s close to your goal!
- If MET goal: Awesome - you met your goal! This time you remembered Y more words. That is a total of X words remembered.
- If EXCEEDED goal: This time you remembered Y more words... Wow – that’s even more than your goal! In total, you remembered X words.
After providing feedback, click ➔ to continue. Now we will move onto the final questions.

**STRAT-ONLY**

Click ➔ to continue.

You have just completed the final list activity. Now we will move onto the final questions.

**RETURN HERE FOR BOTH CONDITIONS**

**Goal Attainment**

Continue administering the session by following the instruction in Qualtrics until you reach the end of the goal attainment questions. The message will be: “Thank you. The research assistant will provide instructions for the next activity.”

**P SELF-COMPLETE SURVEY**

Paste the link to the “P Self-Complete Survey” into the Zoom chat.

You will be able to read and answer the last questions on your computer. I put a link to the last survey in the Zoom chat. Please open that survey and answer the questions there. Let me know if you have any questions.

P’s can complete the last questions at their own pace. Troubleshoot any issues and answer questions as necessary (e.g., having P share their screen if they have issues). The last part of the survey will ask P to select their honorarium choice (2 SONA credit v. raffle for gift card) and will instruct them to let you know they are finished. They will also have another opportunity to download the informed consent form.

While they answer the questions, you can elaborate on any of your notes from the session on the first sheet of the answer packet.

When they are finished, 1) stop recording, 2) thank them, 3) answer any final questions, and 4) tell them goodbye.