The Use of Autobiographical Memory Training to Improve Dementia Symptoms and Prevent Cognitive Decline in Older Adults

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Abstract

Alzheimer's disease is a progressive brain disease characterized by symptoms such as memory loss, language difficulties, and other cognitive deficits. Alzheimer's disease is also the leading cause of dementia. Dementia is not a normal consequence of aging, although it is typically seen in older adults. One area that is affected by dementia is autobiographical memory, which involves the ability to recall personal experiences and events. This literature review searched for existing peer reviewed articles on the topics of normal versus abnormal aging, autobiographical memory structure, and autobiographical memory training. Few studies have examined the effects of a memory flexibility training program in the context of older adults, and even fewer on dementia symptoms. This literature review focuses on the MemFlex intervention, which aims to improve autobiographical memory flexibility during retrieval. Leahy et al. (2018) conducted a study on MemFlex and its effects on cognitive flexibility and autobiographical memory retrieval in non-depressed older adults. Results showed improvement in autobiographical memory specificity, recall of negative memories, and inhibition relating to cognitive flexibility. Future research should examine MemFlex's ability to improve memory and cognition in dementia patients. Other studies might also look at MemFlex's ability to prevent cognitive decline and memory loss in individuals who are at risk for developing dementia.

Keywords: MemFlex, autobiographical memory, autobiographical memory training, memory specificity training, Alzheimer's disease, dementia, mild cognitive impairment, aging

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Florence is 87 years old. She can recall some details about her life from a long time ago, like the fact that she was a special education teacher, or even her Brooklyn address from over 40 years earlier. When asked what today's date is, however, she does not know. Her day-to-day memory is not good, and she requires the care of her daughter, Linda. Linda feels as though she does not have her mother anymore, and misses how her mother used to be before this disease took over. Florence and Linda are real people, whose story was shared by The Cleveland Clinic (2013). Now imagine Florence has a husband named Todd. Todd is close to Florence's age, but doesn't experience the same problems that Florence does. Todd still faces some challenges, like having difficulty finding the right word sometimes. Florence, on the other hand, may have severe trouble joining or keeping up with a conversation. Todd sometimes forgets appointments or names that he is able to recall later, while Florence forgets newly learned information and experiences memory loss that interrupts daily life. Florence tends to repeat the same questions, keeps a notepad on her to write down reminder notes, and relies on the memory of her family members (Alzheimer's Association, 2022). Florence is experiencing abnormal cognitive changes due to Alzheimer's disease, while Todd is experiencing normal age-related changes.

Alzheimer's is a progressive brain disease characterized by symptoms such as memory loss and language difficulties. It is also "the most common cause of dementia" (Alzheimer's Association, 2022, p. 6). Dementia is a general term for a collection of progressive brain diseases, the symptoms of which can include problems with memory, problem-solving, language, and other cognitive skills. Alzheimer's dementia has a

detrimental effect on a person's performance in everyday tasks, and patients eventually require a caregiver (Alzheimer's Association, 2022). A main concern with dementia is losing one's sense of self through the loss of personal memories. The negative effects of dementia often spillover to a patient's family, loved ones, and caregivers. It is still possible to live a fulfilling life with dementia, and there may be ways to improve or maintain memory and other cognitive functions at least for a short period of time.

Although mild forgetfulness is often a normal part of aging, dementia and its symptoms are not (National Institute on Aging, 2020). I conducted this literature review to learn more about whether training people with Alzheimer's disease in retrieving personal memories might help them improve or maintain functioning. In the following review, I will first provide more information about normal and abnormal memory aging. I will then describe the theoretical explanations of autobiographical memory structure. Lastly, I will focus on the MemFlex intervention used for memory training specificity.

Normal and Abnormal Memory Aging

As illustrated by the examples of Florence and Todd, there are differences in memory function between someone who is aging normally, and someone with a diagnosis of Alzeheimer's disease. In addition, there are different stages of memory decline both between normal and abnormal aging, and within people who have dementia.

Normal Memory Changes

In normal aging, we see some forgetfulness, occasional errors such as when managing bills and finances, assistance using certain technologies, momentarily not knowing what day it is, vision changes from cataracts, tip of the tongue phenomenon, retracing steps to locate a misplaced item, etc. (Alzheimer's Association, 2022). Importantly, the memory failures in

people who are aging normally are *temporary*; they forget something but remember it later. While these failures are annoying, they do not impact people's ability to function in daily life.

Tromp et al. (2015) states that older people who are aging normally typically experience difficulties in retrieving memories, especially personal ones. Old age also brings impairment and inefficiencies in attention, visuospatial ability, and executive functions. The deficits in memory retrieval, attention, and executive function, are driven by shrinking of the prefrontal cortex, the first area in the brain to be affected by aging. The medial temporal lobe, the parietal cortex, and the cerebellum are next to change, and tend to show more minimal decline in normal aging. In Alzheimer's disease, however, changes mainly occur in the medial temporal lobe, the hippocampus and adjacent structures specifically, before ultimately affecting the neocortex. With normal aging, there is some trouble moving information in and out of memory, but in Alzheimer's there is the degradation of memory in the hippocampus. This makes memory problems in Alzheimer's more severe because there is nothing there to retrieve (Tromp et al., 2015).

Preclinical Alzheimer's Disease

According to the National Institute on Aging (NIA), there are thought to be three stages of Alzheimer's disease: a "preclinical" stage, mild cognitive impairment (MCI), and finally Alzheimer's dementia. Preclinical Alzheimer's disease can be defined as a stage in which people hold biological characteristics of AD but are still "cognitively normal" (Petersen, 2016). During the preclinical stage, there are the beginnings of the brain changes seen in Alzheimer's disease, but there are no observable clinical symptoms (Sperling et al., 2011)). Biomarkers of the earliest indicators of AD may be measurable in an individual's

brain, but symptoms such as memory loss may not have emerged yet. These biomarkers include abnormal amounts of beta-amyloid protein, changes in tau protein in cerebrospinal fluid and plasma, and a diminished metabolism of glucose. The brain is still able to compensate for these changes, however, so individuals are able to function as usual (Sperling et al., 2011).

Mild Cognitive Impairment

Very few Americans have heard of mild cognitive impairment (MCI), or are familiar with it. The criteria for MCI involves having memory and cognition problems that are more than what is age-related, and demonstrating some memory impairment but not meeting all of the constituents for dementia (Petersen, 2016). MCI due to Alzheimer's disease is a distinct condition with the same symptoms as syndromic MCI (Albert et al., 2011). MCI due to Alzheimer's is caused by biological changes that damage and kill nerve cells in the brain. New problems with memory, thinking, and language may not interfere with the individual's daily functioning. Autonomy is not yet hindered in the MCI stage. It is important to note that MCI does not always lead to Alzheimer's dementia, although it can be an early predictor of the disease: five years after a MCI due to Alzheimer's diagnosis, about 1 in 3 people will acquire dementia (Alzheimer's Association, 2022).

Although most people haven't heard about MCI, almost all primary care physicians (90%) agree that it is crucial to diagnose MCI due to Alzheimer's, although not all of them are confident in their ability to diagnose MCI (Alzheimer's Association, 2022). In identifying suspected Alzheimer's disease in individuals, a clinical diagnosis spectrum is utilized which ranges from mild cognitive impairment (MCI) to preclinical Alzheimer's. Physicians have an

important job of detecting early features of cognitive impairment, which then helps with treatment before the MCI progresses into dementia, and with cognitive improvement.

Alzheimer's Dementia

The final stage, Alzheimer's dementia, involves symptoms such as memory loss, visual and spatial issues, problems with word-finding, and the person's independence is significantly compromised (McKhann et al., 2011). The term dementia refers to conditions characterized by "deterioration in cognitive function beyond what might be expected from the usual consequences of biological ageing" (World Health Organization, 2021). Older people are at a greater risk for Alzheimer's (most Alzheimer's dementia patients are over age 65), but that does not mean that younger people are immune to dementia. Young onset dementia is when symptoms arise before 65 years of age, and this "accounts for up to 9% of cases" (World Health Organization, 2021).

There are three general stages of dementia. There is an early stage, where onset is slow and some symptoms include: difficulty keeping track of time, forgetfulness, and becoming lost in well known locations. In the middle stage, the signs of dementia become more noticeable. In the final stage, there is almost complete dependency and idleness in the patient. This last stage is when memory problems are severe (World Health Organization, 2021). According to the Alzheimer's Association, "more than 6 million Americans are living with Alzheimer's," and this number is expected to increase to about 13 million by the year 2050 (Alzheimer's Association, 2022). With about 10 million new cases a year, there are over 55 million people living with dementia in the world (World Health Organization, 2021). A third of seniors will die with Alzheimer's or dementia, making Alzheimer's more fatal than prostate cancer and breast cancer together (Alzheimer's Association, 2022).

The brains of people with Alzheimer's disease show high levels of two types of abnormal proteins: beta-amyloid and tau. These two proteins are thought to interfere with healthy communication between neurons, leading to a "loss of function and cell death" (National Institute on Aging, 2017). Amyloid plaques form when the bigger amyloid precursor protein is broken down, with beta-amyloid 42 being considered very dangerous. In Alzheimer's disease, "abnormal levels of this naturally occurring protein clump together to form plaques that collect between neurons" and harm cell activity (National Institute on Aging, 2017). Neurofibrillary tangles are formed by abnormal buildup of tau inside of neurons. Tau proteins are supposed to bind and support the microtubules inside of healthy neurons. Abnormal chemical processes in AD cause tau to attach to other tau molecules rather than attaching to microtubules, creating threads that then form neurofibrillary tangles. Synaptic communication is obstructed when "these tangles block the neuron's transport system" (National Institute on Aging, 2017). Researchers have discovered that this harmful tau buildup is specifically located in memory regions of the brain.

Furthermore, microglia do not successfully clear important debris and waste in the Alzheimer's brain, including protein buildup such as beta-amyloid plaques. Eventually, there is cell death and loss of neuronal connections in AD, and many areas of the brain start to physically diminish. AD typically begins with the destruction of brain regions responsible for memory, such as the hippocampus and the entorhinal cortex. Later, the cerebral cortex is affected which harms language, social behavior, and reasoning. Cerebral atrophy, or brain atrophy, causes a "significant loss of brain volume" towards the final phases of AD (National Institute on Aging, 2017). Alzheimer's disease is ultimately fatal (National Institute on Aging, 2017).

The memory problems associated with AD worsen and last over time and affect daily functioning. Alzheimer's memory loss is more severe than normal memory errors. The memory loss that AD patients exhibit is temporally graded, with remote or earlier memories being more preserved than recent memories (Orlovsky et al., 2017). This means they might be able to recall events or information from their childhood or early life, but will forget new information minutes after learning it. Some of the memory problems that Alzheimer's patients might experience include: repeating questions and statements, forgetting conversations, forgetting events and appointments, misplacing belongings, getting lost "in familiar places", forgetting "the names of family members and everyday objects," having difficulty finding words, and difficulties in participating in conversation (Mayo Clinic, 2022).

Although the primary risk factor for dementia is older age, other risk factors include "depression, social isolation, low educational attainment, cognitive inactivity and air pollution" (World Health Organization, 2021). It is possible to reduce one's risk of dementia by taking on a variety of health behaviors, such as exercising, limiting alcohol, not smoking, eating healthy foods, controlling cholesterol and blood sugar, and keeping healthy blood pressure.

For example, Wang et al. (2002) conducted a longitudinal study on the relationship between engagement in social and leisure activities and dementia. Results showed that mental or social stimulation may be protective against the development of dementia. This also suggests that social interaction may help to maintain cognitive functioning in older adults (Wang et al., 2002). Ahlskog et al. (2011) reported on research which suggests that exercise at midlife significantly reduces the risk of dementia. Physical activity at midlife was also shown to significantly reduce risks of later developing MCI. Furthermore, individuals

with dementia or MCI produced better cognitive outcomes after exercising for 6 to 12 months compared to individuals who remained sedentary. Exercise and physical fitness has been shown to improve memory and cognition in the elderly, and to prevent some of the cognitive decline associated with aging (Ahlskog et al., 2011).

While exercise interventions show much promise for reducing both age-related memory declines and risk of dementia, the extent to which cognitive training helps with these problems is less clear. In psychology, there is a history of debate around the utility of cognitive training interventions (e.g., Hertzog et al., 2008; Salthouse, 2006; Simon et al., 2015). Most of this research finds that cognitive training tends to improve performance on the specific task that is trained, but these gains fail to "transfer" to other cognitive abilities or general functioning. In addition, most of the prior work on cognitive training uses materials that are derived from laboratory studies of cognition, which tend to involve stripped-down materials that are not necessarily related to a person's memory for events of their own life (McDermott et al., 2009). It is possible that training people in retrieving personal ("autobiographical") memories may help both normally aging individuals, and those with Alzheimer's disease, hold on to the types of memories that people hold most dear. Before discussing training in autobiographical memory retrieval, it's necessary to describe a bit of what psychologists know about autobiographical memory itself.

Theoretical Explanations of Autobiographical Memory Structure

Autobiographical memory (AM) is the recollection of events and experiences from an individual's personal life (Baddeley, 1992). Autobiographical memory is what allows us to talk about ourselves as unique individuals with unique life stories. Humans have the special ability to mentally travel through time and look back at our pasts. Our past experiences then

support our planning and actions in the future (Markowitsch & Welzer, 2010). AM can be described using a model where memories are temporary mental structures formed inside a self-memory system (SMS) (Conway & Pleydell-Pearce, 2000). The autobiographical memory system integrates narration and various memory skills. This is crucial for our understanding of self, culture, relationships, brain development, and so many experiences that are unique to human beings. The remarkable abilities contained within autobiographical memory is why it continues to be investigated by the diverse fields of developmental, cognitive, and social psychology, among other scientific disciplines (Gülgöz & Sahin-Acar, 2020).

Autobiographical memory is important for the emotional and social well-being of older adults. In the case of dementia, losing AM is devastating and can lead to losing one's sense of self. Empathy, intimacy, teaching, and other social capacities are thought to be supported by AM. Many older adults experience challenges in recalling detailed, specific memories (e.g., the first time they drove a vehicle by themselves) but have an easier time recalling more general memories (e.g., taking driver's education as a teenager) (Leahy et al., 2018). This difference in recall has been associated with a decline in executive functioning when aging. Furthermore, this impaired autobiographical memory specificity (AMS) is linked to a loss of independence and is a possible indicator for depression. Reduced communication might also be explained by how AM is used when talking to someone new and discussing common interests or stories. It has been proposed that autobiographical memory specificity (AMS) declines with age, but the "positivity effect" tends to keep positive memories preserved from impairment (Leahy et al., 2018).

Autobiographical memory can be thought of as a hybrid between semantic and episodic memory, which are two categories of long-term memory. Semantic memory is typically described as memory for information that is not tied to a specific time or place; in the Autobiographical memory system, this includes general knowledge of the self, or the simple facts about one's life. Examples of semantic memories include where you grew up, the name of your elementary school, who your parents are, etc. Episodic memory is event-specific knowledge regarding an individual's past experiences, and is crucial for remembering vivid details from the past during autobiographical memory retrieval (Sheldon et al., 2019). Examples of episodic memory include going to senior prom, your first day at work, graduating from college, etc.

David C. Rubin (1986) describes theoretical frameworks for the organization of autobiographical memory in his book. He uses the following analogy for describing how events of our lives are arranged into greater structures: "grains of sand, for example, are nested in sand castles which are nested in dunes which are nested in a beach, small movements are nested in actions which are nested in events which are nested in whole periods of our lives" (p. 10). Autobiographical memory is also organized temporally, or along a timeline. Memories from the same time period are often recalled together, and in instances of memory loss, memories from similar time periods tend to be lost and recovered jointly. (Rubin, 1986).

A key component of autobiographical memory is that it contains knowledge at various specificity levels. Three general levels of specificity include: lifetime periods, general events, and event-specific knowledge (Conway & Pleydell-Pearce, 2000). Figure 1

illustrates this hierarchical structure of autobiographical memory using these three levels. A combination of these levels are used to construct specific autobiographical memories.

Memories are associated with at least one lifetime period, which contains general event information which then contextualizes event-specific knowledge details. Lifetime periods can be described using details from a period such as actions, common places, knowledge about significant others, goals, activities, and plans. Examples of lifetime period knowledge can include when you went to high school, working for a specific company, when you lived with a specific person, etc. These lifetime periods tend to distinguish a span of time with a discernible beginning and end (Conway & Pleydell-Pearce, 2000).

Next, general events involve more specific information. General events can include activities, repeated events, and individual events that extend over more than one day. Associated events can be grouped together thematically. Examples of general events can include your trip to a foreign country, your repeated hikes through the mountains, learning to drive a vehicle, etc.

Finally, event-specific knowledge (ESK) involves imagery and vivid details that are associated with a specific event (an event that lasts less than one day). One way event details can be accessed is when a distinct detail or theme is recalled and other details follow. Another way these event details can be accessed is in sequential order of which activities occurred first. After either method, supplemental details are "accessed in forward temporal order, suggesting that this was how these representations were organized in long-term memory" (Conway & Pleydell-Pearce, 2000). Examples of ESK can include sounds, visuals, emotions, sensations, and distinct events that make that memory stand out.

These three levels of specificity help organize the structure of autobiographical memory. Obstruction of any of these levels can produce recall difficulties, and might explain the memory problems seen in various conditions. For example, ESK may be destroyed in cases of retrograde amnesia due to brain damage, while some access to lifetime period and general events remains unimpaired (Conway & Pleydell-Pearce, 2000).

Studies in neurology and psychology suggest that there are two main networks for memory retrieval, described by the attention-to-memory (AtoM) hypothesis (Burianová et al., 2012). One route within the AtoM hypothesis is top-down cued retrieval which starts with attention. The second route is less effortful, and is the bottom-up acquisition of attention used during uncued memory retrieval. Bottom-up is involuntary and requires less sifting through memory (Burianová et al., 2012).

Researchers have observed the many useful functions of autobiographical memory across the lifespan. According to theoretical and empirical literature, autobiographical memory serves self, social, and directive functions (Harris et al., 2014). The clinical benefits of narrowing in on autobiographical memory training have already been seen in those struggling with emotional disorders. Some who face emotional disorders also experience challenges in remembering personal life events, or their autobiographical memories. Further research on memory Specificity Training (MeST) can help us understand the effectiveness of certain interventions, the longevity of the effects, and what features of MeST are needed for improved recall and symptoms (Barry et al., 2021). There is an array of interventions being created focusing on training autobiographical memory specificity which permit further research (Barry et al., 2021). The field of autobiographical memory training and similar interventions looks very promising, and is still a very fresh topic within psychology.

Memory Specificity Training

Memory Specificity Training (MeST) first arose as a potential psychotherapeutic intervention for emotional disorders. It is common for people with psychiatric diagnoses such as Post-traumatic Stress Disorder (PTSD), Major Depressive Disorder (MDD), and Schizophrenia to exhibit difficulty in retrieving specific autobiographical memories, similar to the problems that arise in older adults (Barry et al., 2021). The purpose of this literature review is to assess existing research of autobiographical memory training interventions for improving cognition and memory in dementia patients, specifically. Unfortunately, there is currently not a lot of research on autobiographical memory training in this specific population. Through the process of searching for existing literature and research studies, however, I discovered a few training programs relating to autobiographical memory and interventions for typically aging older adults. There have also been other memory-focused interventions for cognitive disorders such as mild cognitive impairment and dementia (Yang et al., 2018). The main memory training program I will be discussing is the MemFlex intervention from Hitchcock et al. (2015), which aims to improve autobiographical memory flexibility during retrieval. There have only been a few studies evaluating the MemFlex program in the context of older adults, and even fewer in dementia patients.

The development of MemFlex comes from attempting to reduce symptoms of depression including maladaptive cognitive patterns and impaired cognitive flexibility. Major depressive disorder (MDD) is correlated with impaired autobiographical memory retrieval and attention (Hitchcock et al., 2015). The trial in 2015 sought to prove MemFlex's ability to improve memory flexibility and diminish depressive symptoms. People with depression exhibit a lack of flexibility when transitioning from general to specific autobiographical

memories, and there is a bias towards recalling negative details. MemFlex involves a low-intensity workbook format which can be used for a variety of psychological therapies (Hitchcock et al., 2015). This cognitive intervention is a combination of memory specificity training and cognitive bias modification (CBM) techniques. There are three areas of flexibility that MemFlex is meant to improve: 1) promoting memory elaboration in order to improve the quality of positive information; 2) lowering negativity bias in attention and memory; and 3) support flexibility when moving between specific and general autobiographical memories (Hitchcock et al., 2015).

In the MemFlex program, one face-to-face meeting introduces the program material, followed by "eight self-guided sessions" (Hitchcock et al., 2015). At the introductory session, a researcher explains various memory systems and the significance of autobiographical memory in daily functioning. In the next four sessions, the participants go through a workbook on their own. The workbook guides the user through cued-recall tasks, and the workbook is completed over four weeks. Session 1 of the workbook covers the "balancing" skill, which refers to improving retrieval of both general and specific memories of positive and neutral affect. Session 2 covers "elaboration," which refers to enhancing memory details and increasing the acquisition of a memory's emotions. Session 3 reinforces the preceding skills, and Session 4 covers "flexibility" between general and specific memories. Participants then practice the various skills in Sessions 5 through 8. Users of the workbook also practice multiple times a day in hopes to develop automaticity of retrieval (Hitchcock et al., 2015).

Leahy et al. (2018) conducted a study on the MemFlex training program and its effects on cognitive flexibility and autobiographical memory retrieval in typically aging older adults. Thirty-nine non-depressed older adults (aged 70+) were used to investigate the effects

of MemFlex "on AMS, valence and the executive functions underlying cognitive flexibility" (Leahy et al., 2018). The MemFlex condition had participants work through the MemFlex workbook activities, which was adapted for non-depressed older adults from the original Hitchcock et al. (2015) workbook. The word "depression" was replaced with "low mood," and "therapist" was replaced with "researcher," for example (Leahy et al., 2018). The control condition had participants work through a control workbook for healthy aging that did not focus on changing memory retrieval. Although autobiographical memory specificity did improve in people who completed the MemFlex intervention, it also improved in the people who completed the control workbook. This study provided promising evidence that autobiographical memory flexibility training can be used as an intervention for encouraging psychological and social well-being in the elderly (Leahy et al., 2018), although it suggests that this improvement may not be specific to participation in MemFlex.

The benefits of MemFlex may also be long-lasting. Hitchcock et al. (2021) provides the first assessment of using the MemFlex intervention for depressive relapse prevention. This study provides a follow-up on the impacts of autobiographical memory training on the impacts "of autobiographical memory training on autobiographical memory processes themselves" (Hitchcock et al., 2021). Results of this study showed that the MemFlex intervention contributed to long-term advances in memory retrieval.

The MemFlex intervention may have potential for use as a preventative measure for future cognitive decline or memory loss. Future studies could look at MemFlex's ability to improve memory and cognition in individuals who are at risk for dementia, but have not yet developed the disease. Participants might include those with mild cognitive impairment or

preclinical Alzheimer's disease. People with MCI would also likely be able to work through the workbook on their own, and remain mostly engaged.

It would most likely be difficult to use the MemFlex intervention on dementia patients themselves, considering that the storage of new memories becomes impossible (Jahn, 2013). It might be possible, however, to adapt MemFlex to train retrieval of remote autobiographical memories in people with dementia. In AD, early or remote memories tend to be more preserved than recent memories (Orlovsky et al., 2017). The intervention and workbook can focus on reaching the memories from when the person was younger, for example.

Rather than reducing cognitive decline, training the retrieval of early memories might improve mood and functioning similar to the effects of MeST on depression (Barry et al., 2021). In fact, depression is an early symptom of dementia, and people with a history of depression are at an increased risk for developing dementia (Byers & Yaffe, 2011).Retrieving earlier, more pleasant memories might improve the mood and quality of life for the patient.

Finally, it is important to note that MemFlex is a self paced workbook, which requires attention and engagement to keep up with it. One way to adapt this for dementia patients would be to have them work through it with a family member or caregiver, or with a group of others who are using the workbook. It would also be beneficial if the caregiver went with the patient to the initial meeting, that way all involved can better understand how MemFlex works. Doing the workbook with other people, and the sharing of memories this would encourage, might be another beneficial outcome of the program.

Conclusions

Alzheimer's disease is a devastating disease which impacts memory, cognition, language, daily functioning, relationships, and well-being. The effects of Alzheimer's can especially be detrimental for family and caregivers. One specific area affected by Alzheimer's dementia is autobiographical memory. There has been a variety of memory specificity training interventions proposed over the years, including training in autobiographical memory. Few studies have looked at the effects of a memory flexibility training program on older adults, and even fewer on dementia or the risks for dementia.

The MemFlex training program was tested by Leahy et al. (2018), and it was found that AMS and retrieval inhibition improved. Participants recalled more negative memories, which can help counter the positivity effect in older adults. Leahy et al. (2018) provides evidence that MemFlex can be used to improve psychological and social factors in the elderly. MemFlex is able to increase well-being in older adults, as well. Other assessments of MemFlex have shown that it contributes to long-term improvements in memory retrieval.

Leahy et al. (2018) serves as an example of how MemFlex can be adapted for varying purposes and differing subject groups. Adapting MemFlex for Alzheimer's patients would be challenging, however. Alzheimer's patients lose their independence, and struggle to initiate and complete tasks due to impaired memory. MemFlex was originally designed as a self-paced, self-guided workbook. It would be almost impossible for a dementia patient to regularly guide themselves through the workbook on their own. If MemFlex were to be used by dementia patients, reoccurring guidance from a caregiver or family member would be needed in order to complete the program. Subsequently, the hope would be to improve executive functioning, remaining cognitive skills, and AMS of whatever memories are still present. In the final stages of dementia, preventing further memory decline would be

unlikely, but it would still be possible to improve mood and well-being. By elaborating on any remote memories still present, the patient might find joy from their early life events. Improvement in the functioning, mood, and quality of life in a dementia patient can help alleviate some of the distressing moments caregivers experience. The well-being of caregivers and family members would improve as a result of the intervention.

Future research should investigate the effectiveness of MemFlex on improving the quality of life for dementia patients and their caregivers. Future research should also focus on adapting MemFlex for people with MCI, preclinical Alzheimer's disease, and those who are at potential risk for developing dementia. Autonomy is not yet impeded at these stages, and individuals still have use of functions required to complete the MemFlex workbook independently. It would be optimal if MemFlex had the ability to prevent the onset of dementia, or at least mitigate any dementia symptoms that do develop. MemFlex might also be useful in preventing MCI, or in lessening the severity of age-related memory and cognition problems. Future research can also include longitudinal studies on the effects of MemFlex. A longitudinal study could start with individuals in early adulthood, or younger, using a MemFlex intervention meant to prevent dementia or MCI symptoms later in life. The study would then follow these same individuals as they enter middle adulthood, late adulthood, and late late adulthood.

The information from this literature review can be tied back to the story of Florence, an 87-year-old woman with Alzheimer's disease. There are many important differences between the memory and cognition problems Florence faces and the problems associated with normal aging. As Florence enters the final stage of Alzheimer's, she will become completely dependent on the help of others, and her memory problems will worsen.

Florence's quality of life can still be helped, however, with research suggesting that social interaction, mental stimulation, and physical activity can improve the severity of her symptoms. Florence can also use an adapted version of the MemFlex intervention to improve retrieval inhibition, executive functions, and specificity of her remaining autobiographical memories. Florence's daughter and caregiver, Linda, can help guide Florence through the completion of the workbook. Florence might experience increased well-being and mood regulation, subsequently improving her relationships with everyone in her life. Linda would then see a positive change in her mother, and might witness more pieces of who her mother used to be. Hopefully, with the help of MemFlex, some of Linda's stress from caring for her mother will be alleviated, and she can enjoy the company of her loving mother for a while longer.

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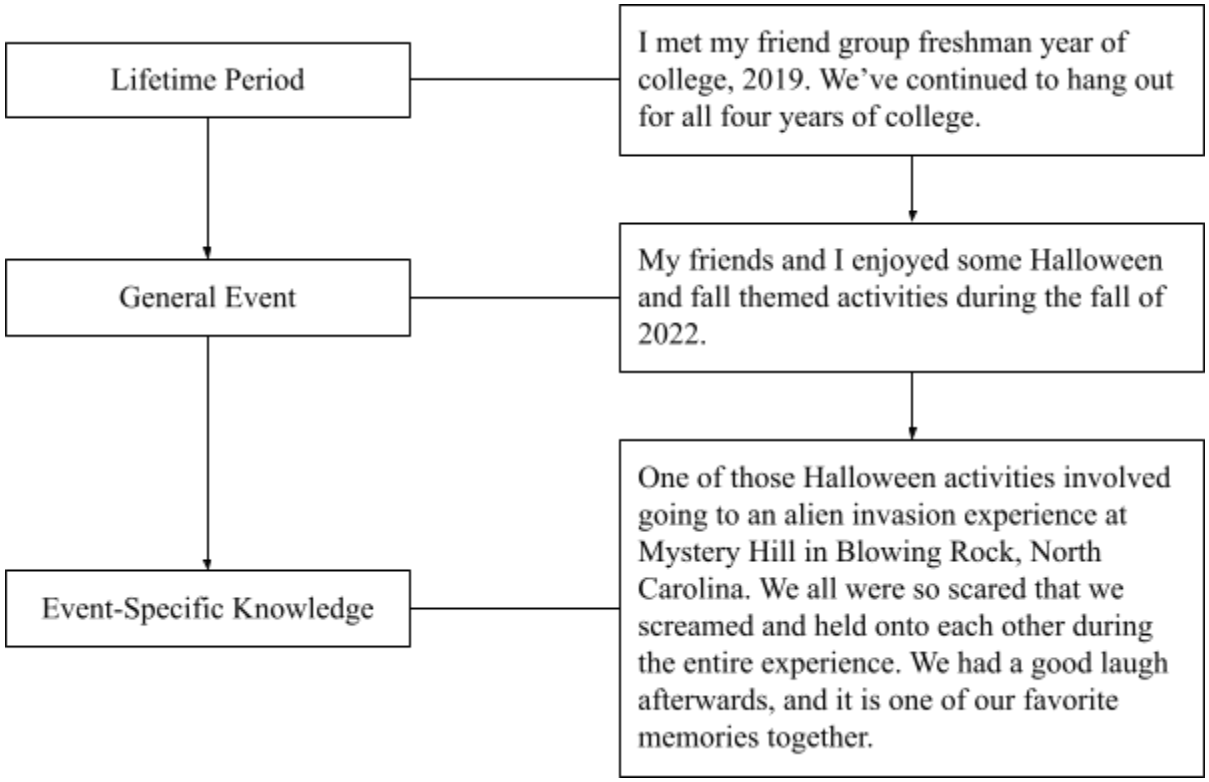

Figure 1. Illustration of the three broad levels of specificity for autobiographical memory. The lifetime period, general event, and event-specific knowledge levels are included. These three levels are illustrated using an example of an autobiographical memory. The personal memory is described at each level. Lifetime period is the least specific level, general event is more specific, and event-specific knowledge is the most specific level. The personal memory used was created by the author.