# CAN PERSONAL MEMORIES AND FICTIONAL STORIES ENHANCE RETENTION OF NOVEL WORDS AND FACTS?

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A DISSERTATION SUBMITTED TO
THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

GRADUATE PROGRAM IN
PSYCHOLOGY
YORK UNIVERSITY,
TORONTO, ONTARIO

JULY, 2023

**Abstract**

Two strategies that increase memory retention are the self-reference effect and generation effect. The generation effect involves the self generating the stimuli to-be-remembered. The self-reference effect involves knowledge about the self. Previous studies have compared the 'self' and 'other' conditions to determine whether a memory advantage exists. However, one novel way to compare these elements is directly comparing the 'self' and 'other' while also comparing effects of either asking participants to come up with an episodic AM or story narrative to associate with the to-be-remembered stimuli. Both studies in this dissertation had young adults complete two sessions separated by a two-day delay. Participants were divided into two groups: AM group and Story group. Each group learned adjective words (Study 1) or facts (Study 2) in conditions that differed in encoding task: baseline, self and other. Later, participants were tested on their retention of the words (Study 1) or facts (Study 2) using free recall and recognition subtasks. In both studies, memory performance was higher for all four experimental conditions compared to baseline. In Study 1 free recall subtask, recall of words was higher for AM group-self than Story group-self. However, no differences were found in recall between AM group-other and Story group-other. In Study 1 recognition subtask, there was a memory advantage for the self but no differences were found between AM and Story groups. In Study 2 free recall subtask, there were no differences in recall between the self and other conditions in the AM group. However, in the Story group, the number of facts recalled in the self condition was higher than the other condition. Moreover, in Study 2, recall of facts was higher for self condition in the Story group than AM group. In Study 2 recognition subtask, we found differences between AM and Story groups. These results can inform educators about strategies used to promote learning within the classroom.

**Acknowledgements**

I am grateful to so many who have supported me during the writing process of this dissertation and throughout my graduate school journey. I would like to acknowledge and give my warmest thanks to my wonderful supervisor Dr. Thanujeni Pathman who made this work possible. Her guidance, advice and endless support carried me through all of the stages of my graduate school journey. She never failed to continuously provide encouragement and was always willing and happy to assist me in any way she could throughout the years. I would also like to thank my amazing committee members Dr. Mary Desrocher, Dr. Sheila Cunningham and Dr. Shayna Rosenbaum who offered guidance and support throughout the writing process of this dissertation. I would like to thank all of the dissertation committee members as well for reading this dissertation and coming up with insightful comments and feedback.

I would also like to give a special thanks to my family members for their continuous support and understanding when undertaking my research project. I could not have done this without their love and encouragement and I am forever grateful to them for everything they have done for me.

Lastly, I would like to give a big thank you to all of the MDLab members that helped transcribe, code and double check documents. I would not have been able to complete this project without their help.

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# Can Personal Memories and Fictional Stories Enhance Retention of Novel Words and Facts?

Autobiographical memory (AM) is the ability to recount personal events that happened in the past (Fivush, 2011). It comprises of two distinct components which include semantic AM and episodic AM (Tulving, 2002). Both episodic AM and semantic AM systems differ in the type of information they encompass and the nature of the memory retrieval process (Burianova et al., 2010; Brown et al., 2018). Semantic AM involves general knowledge and factual information about one's life. However, it does not involve a detailed recollection of specific events (e.g., time and place) but focuses on the broader understanding of oneself. For example, knowledge about personal attributes such as recalling your date of birth, educational background or names of family members. On the other hand, episodic AM is the ability to recount personal events experienced in the past that are specific in time and place (e.g., attending your university graduation ceremony) (Levine et al., 2002; Tulving, 2002). Episodic AM involves various components such as emotional, perceptual, and sensory details; all of these play a crucial role as they allow us to retain and form rich and detailed personal narratives that can be later recalled helping us make sense of our experiences (Bauer, 2007; Addis et al, 2004). For example, when you attended your own graduation ceremony you are likely to remember the way the auditorium looked, the way you felt crossing the stage and your family members reactions as they congratulated you on your achievement. Our thoughts, emotional reactions and perceptions are considered factors that shape our episodic autobiographical memory (Bauer, 2007). Our memories would not feel complete without being able to recall these elements that help shape our life narrative.

**Autobiographical Memory Narratives**

To assess AM, researchers often ask participants to describe a specific past event with an open-ended question (Nelson & Fivush, 2004; Haden & Hoffman, 2013; Bauer, 2015; Reese, 2015). Participants typically provide a detailed and rich description of the event that occurred forming a narrative (Nelson & Fivush, 2004). These AM narratives play a vital role in the construction and organization of personal events experienced by individuals. AM narratives typically involve various contextual, perceptual and emotional details of past events to shape coherent and meaningful stories (Addis et al, 2004). Narratives play a crucial role in shaping one's sense of self and personal identity as they provide a way for individuals to make sense of their past, understand their present and project themselves in the future (Bruner, 1991; Gottschall, 2012). Through storytelling and interpretation, humans create a sense of purpose and direction in their lives. Although narratives provide structure to human experience, they also provide ways of understanding the world (Hammack, 2008; Syed, 2015). They allow individuals to structure their experiences in a way that subjectively appeals to their understandings of life and the process of making sense of their life experiences (Bruner, 1987; Kroger, 1996; Kunnen & Bosma, 2000).

Modern cultures often reinforce the importance of recalling autobiographical narratives to communicate with others. From birth, caregivers communicate with their infants through story telling forming an ongoing family narrative (Fiese, Hooker, Kotary, Schwagler & Rimmer, 1995). Scaffolding happens as the child's ability to narrate stories develops and asking various questions to elaborate on their understandings of the world is also encouraged (Reese, 2002). For example, mothers will ask "What did you do at school today?" and continue to ask follow up questions such as "What else did you do?" Children learn that sharing their personal memories

and stories is an important social activity and highly encouraged. As the child grows and becomes an adult, narratives often develop and move beyond reporting sequences of what happened to include more detailed and rich information about how and why an event occurred. For example, individuals report what they were thinking or why a situation happened in the way it did. These narratives become serving a function such as defining the self, relationships with others and communicating life lessons (Bluck & Alea, 2002; Pillemer, 1998). Therefore, it is clear that personal narratives are valued and viewed as an essential part of everyday conversation beginning early in development and throughout the lifespan.

**Autobiographical Memory Narratives and Learning in the Classroom**

AM narratives can be a valuable tool for learning in the classroom. However, very few studies have examined whether linking educational content learned in the classroom with past AM's impacts memory performance (Grilli & Glisky, 2010; Reeder, McCormick & Esselman, 1982; De Graaf, 2022). One of these studies was conducted by Hartlep and Forsyth (2000). They examined this phenomenon by randomly assigning college students to three experimental conditions while asking them to study a chapter from a child psychology textbook. One group was asked to use a self-referencing method (e.g., students were asked to reflect on how their own life experiences relate to what they were reading). Another group was asked to use a study method called survey, question, read, recite, reflect and review method (SQ3R). The last group was the control group where participants were not given any specific instructions but to "try your best." All participants completed an exam immediately after and again two weeks later. Researchers found that self-referencing enhanced retention of the studied information. Therefore, memory performance of the studied material was higher in the group that related AM narratives with the to-be-learned material. Moreover, incorporating AM narratives in the classroom could

be done in multiple ways such as writing assignments, group discussions and presentations. Educators could provide prompts or guided questions to encourage students to reflect on their own AM narratives when learning. Therefore, this approach could promote student-centered learning and self-reflection.

**Fictional Stories**

Fictional stories have the power to evoke emotions, transport us to different worlds and expand our imagination (Slater et al., 2014). As we engage with these stories, we might find ourselves relating to the characters, the challenges they face and the obstacles they overcome. These stories can have a lasting impact on our thoughts and understandings of the world around us as they can have some relatable elements (Webber, Wilkinson, Duncan & Mcgeown, 2022). For example, we could remember a powerfully written scene that reminds us of our own experiences and leaves a lasting impression. When people read stories, they can invoke personal experiences as our own past could be related to what is being read (Mar, 2018). Furthermore, studies using MRI scans have found that reading fictional stories can induce neural connectivity in the somatosensory cortex (Berns, Blaine, Prietula & Pye, 2013). This suggests that the individual reading the story is placed in the body of the protagonist. This allows the individual to vicariously experience the 'other' state of being (Marshall, 2020). Therefore, simply engaging with fictional stories can have powerful outcomes on the way we perceive our own lives.

Not only does reading fictional stories allow us to reflect on our own lives but the process of generating them can also be similar to narrating real life events. Essential components when generating a story include incorporating characters, a plot (beginning, middle and end), a challenge, a choice and a resolution (McAdam, 1993; Ganz, 2010). When individuals make up fictional stories, they use a similar structure that is used when people narrate their own real life

experienced events (Graesser, Singer & Trabasso, 1994). For example, people narrate real life events in a chronologically organized structure and similar structures often exist in stories. Moreover, the content of generated stories can also parallel that of events experienced in real life (Graesser, McNamara & Louwerse, 2003) since many stories are about people, their mental states and relationships which may have human-like characteristics. For example, stories could be about healthy family dynamics which could be a real lived experience for some (Mar & Oately, 2008). In addition, since stories contain high-level semantics and contextual information, when individuals read narratives it could be that it requires deep meaning-centered processing which leads to lingering (Bellana, Mahabal & Honey, 2022). Similarly, generating fictional stories has various properties that contain high level of semantic information which could be processed in a deeper manner. This is similar to when individuals narrate specific experienced events as they are personally relevant and lead to better memory recall (Bauer & Lukowski, 2010; Riggins, 2014). Overall, the process of generating fictional stories and the elements involved (e.g., plot, conflict, resolution, etc.) can parallel that of events experienced in real life, making both stories and personal memories similar to each other.

**Fictional Stories and Learning in the Classroom**

It is evident that educators have acknowledged that middle and high school students do not attain strong literacy skills for content learning in school (Palumbo & Sanacore, 2009; Rose, 2008). Similarly, studies suggest that elementary students have a hard time grasping content knowledge from textbooks alone (Atkinson, Matusevich, & Huber, 2009). One way to combat this is by using fictional stories within the classroom as they play an important role in enhancing learning across various subjects and age groups. They are effective tools for learners as they can facilitate cognitive processes such as concretizing and assimilation (Evans & Evans, 1989).

Concretizing in stories involves helping readers make sense of an abstract or complex subject matter through making links with tangible or concrete examples. For example, when using stories to explore the topic of electricity in school, this can lead to improved performance that used the stories to create a more tangible grasp of the topic and relationship between concepts (Simons, 1984). Assimilation suggests that learning is a process of integrating new information with current information and cognitive structures (e.g., scaffolding). When using well-known fictional stories that are relatable to the majority, it can be an effective way of introducing novel topics or concepts to learners as they can comprehend information in a new perspective. Therefore, when introducing stories in the learning process, students benefit and are able to make connections between subject material and the stories leading to better understanding of the material.

**Present Studies**

The goal of the two research studies included in this dissertation is to contribute to our knowledge about enhancing learning in the classroom. Since AM is a powerful part of the human experience, it could be capitalized to enhance learning. Similarly, fictional stories are also engaging and can benefit students when used in the classroom. Both studies outlined in this dissertation explore whether using AM narratives and fictional stories can be useful strategies for novel learning and boost memory performance. The present studies extend the memory literature by building upon two strategies that involve deeper levels of processing and increase memory retention: the self-reference effect and generation effect. The self-reference effect suggests that individuals have better memory recall for information that is related to themselves as opposed to information that is not self-relevant (Rogers, Kuiper & Kirker, 1977; Symons & Johnson, 1997). Previous studies have presented a list of adjective words and asked participants to determine if

each word described themselves or the experimenter (e.g., other). They found that words that were self-referenced had a memory advantage compared to words that were not self-referenced (Klein & Kihlstron, 1986; Rogers, Kuiper, & Kirker, 1977, Kuiper & Rogers, 1979; Maki & McCaul, 1985; Bellezza, 1984; Klein & Loftus, McCormick & Esselman, 1987). Similarly, the generation effect is another robust phenomenon which suggests that individuals show better memory performance for information that they have generated or produced themselves compared to information that someone else provided (Slamecka & Graf, 1978; McFarland, Frey & Rhodes, 1980). For example, past studies have tested this by presenting participants with pairs of words during the learning phase and after showing them one of the words in the pair and asking them to generate the second word (Slamecka & Graf, 1978; McFarland, Frey & Rhodes, 1980; Watkins & Sechler, 1988). Researchers found that participants had a memory advantage for words they generated themselves compared to words that were presented to them. Both the self-reference effect and the generation effect involve the 'self' in different ways. The self-reference effect involves knowledge about the self and the generation effect involves the self (e.g., participant) generating or creating to-be-remembered stimuli. Here we capitalize on the potential for 'the self' to boost new learning, and additionally link this work to previously described literature on the importance of AM and fictional stories.

The two proposed studies extend the literature on the generation effect and self-reference effect in new ways. We will examine whether episodic AM boosts memory performance during new learning. In both studies, participants were asked to retrieve an episodic AM related to the studied material during learning, and we tested whether this encoding strategy would boost retention for the studied material. To examine the importance of the 'self' and the importance of 'generation type' during learning, we included additional experimental conditions. To examine

the importance of the 'generation type,' participants were asked to either retrieve an AM or create a fictional story (depending on group assignment; AM vs Story manipulation was between subjects) related with the studied material. To examine the importance of 'the self,' for each group, participants came up with their own AM/story or listened to someone else's AM/story (self vs. other manipulation was within subjects). All of these comparisons were done to investigate which strategy boots memory performance the most.

The difference between Study 1 and Study 2 was the material to be learned. In Study 1, the to-be-learned material were adjective words (e.g., 'kind') to mimic past studies that have used the same stimuli on the self-reference effect (Klein & Kihlstorm, 1986; Rogers, Kuiper & Kirker, 1977; Klein, Burton & Loftus, 1989). However, relatively few studies have used to-be-tested material that closely resembles material taught in the classroom when examining the self-reference effect and generation effect. Therefore, in Study 2, our goal was to examine the same research objectives in Study 1 but for which the to-be-learned material were novel facts that closely resemble realistic material taught in the classroom. This study would provide educators with the knowledge needed to be able to promote the most beneficial and effective learning strategies that could boost memory performance the most.

**Abstract (Study 1)**

Robust strategies that increase memory retention include the self-reference effect (SRE) and generation effect. Both strategies involve the 'self' in different ways. Previous studies have compared 'self' (relate stimuli to yourself) and 'other' (relate stimuli to another) conditions to determine differences in memory retention for stimuli like adjective words. However, additional strategies that could also be compared are retrieving an episodic autobiographical memory (AM) or generating a fictional story narrative related to the to-be-remembered stimuli. Here, young adults (*N*=111) completed two sessions separated by a two-day delay. Participants were divided into two groups: AM group and Story group. Each group learned adjective words in conditions that differed in encoding task: Baseline (count vowels in each word), Self (relate word to their own memory/story) and Other (listen to someone else's memory/story). Later, participants were tested on their retention of the words using free recall, recognition and justification subtasks. Memory performance was higher for all four experimental conditions compared to baseline. In the free recall subtask, recall of words was higher for AM group-self than Story group-self conditions. However, there were no differences in recall between AM group-other and Story group-other. In the recognition subtask, we found advantage for self; there was no difference between AM and Story groups. Lastly, for the justification, we measured how often participants correctly identified the condition (source) for each word, and found participants provided the most correct justification responses for the self condition, followed by the other and fewest for baseline. Overall, the results could provide educators insight about encoding strategies to optimize new learning.

## STUDY 1

Anna is a first-year university student preparing to study for an upcoming Cognitive Psychology midterm. Some strategies she might use to study include rehearsing the material, rereading the textbook and taking notes. Although these strategies seem to help Anna review the to-be-tested material, she still found herself scoring lower on the midterm than she anticipated. Anna's experience is typically the case for majority of university students (Holdaway & Kelloway, 1987; Pepper, 2006). Fortunately, cognitive and educational psychologists have been developing and evaluating the efficacy of various learning strategies for decades to understand which techniques help students achieve their learning goals, facilitate student learning and increase retention of memory long-term (Dunlosky et al., 2013).

In the memory literature, two highly robust strategies that involve deeper levels of processing and ultimately increase memory retention are the self-reference effect and generation effect. The self-reference effect is a robust finding that suggests individuals show enhanced memory for information that is encoded when linking it with the self (Klein & Kihlstron, 1986; Conway & Dewhurst, 1995; Craik & Tulving, 1975; Rogers, Kuiper, & Kirker, 1977, Kuiper & Rogers, 1979; Maki & McCaul, 1985; Bellezza, 1984; Klein & Loftus, 1988; Reeder, McCormick & Esselman, 1987; Glisky & Marquine, 2009; Gutchess, Kensinger, & Schacter, 2010; Gutchess, Kensinger, Yoon & Schacter, 2007; Mueller, Wonderlich & Dugan, 1986). The first method that researchers have used to test this effect is investigating how participants' incidental memory for trait adjectives (e.g., brave, ambitious, etc.) differed based on whether they studied the words in relation to a self-description ("Does this adjective describe you?") or studied the words in other encoding conditions that did not involve the self. The other encoding conditions included asking participants to judge the word for its appearance ("Is this word

printed in all capital letters?"), for its phonetic features ("Does it rhyme with high?"), and for its semantic meaning ("Does it mean the same as assertive?") (Rogers, Kuiper, & Kirker, 1977; Symons & Johnson, 1997). These studies found that trait adjectives were better remembered if they were studied in the self-description condition as opposed to the other comparison conditions (e.g., appearance, phonetic and semantic).

One explanation to why relating information to the self has been shown to be an effective and robust strategy is because it involves deeper levels of processing and elaboration. Craik and Lockhart (1972) proposed the depth of processing theory which suggests that incidental learning occurs at various "depths" which corresponds to the degree of semantic attachment. Information that is processed at a deeper level is more likely to be remembered in comparison with information processed at a shallow level. Additionally, the self-reference effect may be attributed to superior elaborative and organizational properties since links between the to-be-tested stimuli and self are being encoded (Klein & Loftus, 1988). When stimuli and self-cues are linked simultaneously, the 'self' might strengthen the level of processing of stimuli in which the self-reference effect occurs. This way of processing provides multiple routes for retrieval and provides "inference-based reconstruction" when participants are unable to retrieve the to-be-remembered stimuli (Klein & Kihlstorm, 1986; Klein & Loftus, 1988; Symons & Johnson, 1997; Keenan, Golding & Brown, 1992; Klein & Nelson, 2014). Therefore, the 'self' can be used to process information at a deeper level.

A second highly robust memory strategy that has been examined is generation of to-be-learned stimuli. The generation effect is a phenomenon that suggests people retain information or stimuli they have generated better than information or stimuli generated by others like the experimenter (Slamecka & Graf, 1978; McFarland, Frey & Rhodes, 1980). This is a robust

finding that is typically found in laboratory settings where one group of participants generate words (e.g., tiger) from presented word fragments (e.g., ti__er) and another group is asked to simply read the presented words (Watkins & Sechler, 1988). The group that generated the words (e.g., completed the word fragments) had better recall than the group that read the words. This effect has also been demonstrated using different stimuli such as headings instead of words. For example, Brooks, Dansereau, Holley and Spurlin (1983) examined the effects of student-generated versus experimenter-provided headings as processing aids when studying. Students that generated their own headings performed significantly higher than students who studied text with experimenter-generated headings and the control group. Other stimuli that have been used to test this effect include mathematical computations (Crutcher and Healy, 1989). For example, Crutcher and Healy (1989) examined whether a memory advantage exists when participants generate multiplication responses rather than simply reading responses provided by another agent. Participants were either given multiplication problems with the answers present or absent and with the calculations performed either by themselves or another agent. Immediately after, participants completed a recall test of the answers. They found a significant retention advantage for tasks that involved multiplication operations performed by the participants themselves in comparison to another agent. However, there was no significant difference regarding whether the answers were present or absent in the original problem. In all these studies, the results show that self-generated stimuli are better retained than externally generated stimuli.

There are various theories that try to explain why the generation effect is robust. One theory suggests that self-generation requires a lot of mental effort and uses more cognitive operations at encoding which could be the reason for better memory. For example, Tyler et al. (1979) demonstrated that higher effort generation (solving for difficult sentence completion)

caused higher memory recall in comparison with low-effort generation (sentences easier to complete and solve). Another theory that could explain this effect is the activation theory (McElroy & Slamecka, 1982). This suggests that the act of generating information promotes access to semantic information which strengthens the memory trace and ultimately leads to higher memory performance. Therefore, both theories could be operating in a way that leads to better incidental memory performance.

Both the self-reference effect and generation effect involve the 'self' in different ways. The self-reference effect taps into the 'self' via autobiographical memory (AM), either semantic AM (knowledge about themselves; e.g., "I am 30 years old", "I am honest") or episodic AM (memories about specific personal past events; e.g., memory for a trip to the Toronto Zoo on your birthday) (Levine et al., 2000). At encoding, participants can be asked to process to-be-remembered stimuli (words) in relation to their semantic AM (e.g., does the word 'honest' describe me?) (Klein & Loftus, 1988; Rogers, Kuiper, & Kirker, 1977; Klein & Kihlstron, 1986; Conway & Dewhurst, 1995). Participants can also be asked to process to-be-remembered stimuli in relation to their episodic AM (e.g., presenting participants with adjective traits and asking them to relate each adjective to a personal experience; Klein, Burton & Loftus, 1989; Bellezza, 1984). Studies have shown that whether participants are asked to associate stimuli to themselves via semantic AM or episodic AM, retention is similar (Hartlep & Forsyth, 2000) and better than encoding strategies involving only perceptual processing of stimuli or relating stimuli to 'other' (Czienskowski & Giljohann, 2002; McCormick & Esselman, 1982; Rogers, Kuiper & Kirker, 1977; Maki & McCaul, 1985). These components can be viewed as separate pathways that allow us to process information at deeper levels and retain our personal events long-term (Klein & Loftus, 1988). On the other hand, the generation effect involves the 'self' (e.g., participant)

generating or creating the to-be-remembered stimuli. For example, when participants are asked to generate the to-be-tested stimuli, that process involves the 'self' organizing thoughts and ideas to select the appropriate information to recall. Regardless of the memory advantage that the self-reference effect demonstrates, whether or not individuals apply this strategy depends on their cognitive abilities and intrinsic motivational disposition (Cacioppo, Petty, Feinstein & Jarvis, 1996). This is the tendency for individuals to engage in and take part in effortful cognitive tasks. The 'self' is an important aspect in how deeply individuals think about the information they generate. Therefore, there are individual differences that shape the way the self-generation effect is applied.

Since both the self-reference effect and generation effect are strategies that involve the 'self,' they are often compared with encoding tasks involving the 'other.' For example, some self-reference studies have found that encoding objects while thinking about themselves (e.g., "do you like flowers?") elicits a memory advantage over objects encoded about others (e.g., "would the researcher like vegetables?") (Sui & Zhu, 2005; Cunningham et al., 2014; Carroll & Davis, 2001). In some self-reference studies with a generation component, 'self' and 'other' conditions are directly compared. One study that compared the 'self' and 'other' conditions to examine the generation effect was conducted by Carroll and Davis (2001). They asked undergraduate students to generate words (e.g., names of their towns or hobbies) themselves or to listen to their partner's generated words. After a delay, participants recognition memory performance was significantly better for self-generated than for other-generated words. Another similar study which involved the 'self' and 'other' was conducted by Turk, Gillespie-Smith, Harvard, Conway, and Cunningham (2015) who asked 7- to 9- year-olds to learn the spelling of four nonsense words. Participants were asked to copy the words and generate sentences. Some of

the participants were asked to include themselves as the main character in the sentence (self-referent condition) while others were asked to generate a sentence about someone else (other-referent condition). They found that children who included themselves in the sentence came up with longer sentences and showed increased spelling accuracy in comparison with children in the other-referent condition. Most of these studies show that using the 'self' during encoding is the most advantageous and reliable encoding strategy as opposed to comparison groups such as the 'other.'

The self-reference effect and generation effect have been compared with the 'other' condition using various types of stimuli, including adjectives (Klein & Kihlstorm, 1986; Rogers, Kuiper & Kirker, 1977; Klein, Burton & Loftus, 1989), nouns (Maki & McCaul, 1985; Czienskowski & Giljohann, 2002; Warren, Chattin, Thompson & Tomsky, 1983), narrative information (Grilli & Glisky, 2010; Carson, Murphy, Moscovitch & Rosenbaum, 2016; Reeder, McCormick & Esselman, 1982; De Graaf, 2022), and text from books (Hartlep & Forsyth, 2000). In majority of these studies, regardless of the variations in the to-be-remembered stimuli, using the 'self' boosts overall memory performance compared to the 'other'. Since the 'self' has been compared to the 'other' condition using different stimuli, one set of unique and novel way to compare these elements that has not been examined is directly comparing the 'self' and 'other' encoding strategies (conditions) while also comparing the effects of either asking participants to come up with an episodic AM or story narratives to associate with the to-be-remembered stimuli. Directly comparing both 'self' and 'other' conditions with each generation type (AM versus Story) can provide us with new knowledge about how these elements interact and which ones can enhance and optimize memory performance the most. Additionally, generating fictional stories has various properties that contain high-level of semantic information which could be

processed in a deeper manner. Typically, stories include characters, conflict, tension that builds to a climax (De Beaugrande & Colby, 1979) followed by a resolution (Graesser et al., 1991). Similarly, when individuals make up a fictional story, they include a collection of information while integrating events, relationships, intents, emotions and abstract thought. Therefore, stories possess a clear and familiar structure that progresses through chronological order of events (Berman & Nir-Sagiv, 2007). Moreover, people experience life in the real world as temporally ordered events, organized around personal goals which result in emotional experiences; stories parallel the structure of human lived experiences (Graesser, McNamara & Louwerse, 2003; Graesser, Singer & Trabasso, 1994). The content of stories is also closely related to our everyday experiences. Stories are usually on common themes that are typically familiar to us (Hogan, 2003) such as social relationships, human psychology and interpersonal interactions (Mar & Oately, 2008). Therefore, given the close similarities between the structure and content of stories to human lived experiences, we chose to use stories and compare them to episodic AMs to understand which boosts memory performance the most.

In the present study, we wanted to investigate whether episodic AM would boost memory performance while encoding adjective words, but we also wanted to have other experimental conditions where participants were asked to either come up with fictional stories or listen to someone else's fictional stories to compare whether those different strategies impact memory performance. Asking participants to come up with their own fictional stories requires the use of the 'self' in the generation sense but not in the AM sense. The 'self' story does not involve AM. Therefore, we wanted to compare the 'self' Story (this type of comparison with the story addition is unique and has not been previously examined) and 'self' AM. Also, we wanted to compare the 'Self' groups (e.g., AM and Story) with the 'Other' groups to make it equivalent. The self-

reference AM was compared with other types of encoding strategies including other-reference AM, self-generated story and other-generated story to examine which boosts memory of words the most. We further wanted to examine whether individual differences in how elaborate the memories or stories generated were related to memory retention. This study has implications in education as the results could inform educators about how episodic AMs and fictional stories can be used to enhance retention in young adults and which strategy is most effective and should be utilized and promoted within the classroom.

Here, young adults completed two sessions (via Zoom) separated by a two-day delay. Participants were divided into two groups: the AM group and Story group (between-subjects variable). Each group took part in 'baseline,' 'self,' and 'other' conditions (within-subjects variable). For both groups, in the 'baseline' condition, participants saw words and counted the number of vowel(s) in each word. In the AM group, 'self' condition, participants saw words and provided one past memory that related with each word. In the 'other' condition, these participants listened to recordings of someone else's memory for each word. In the Story group, 'self' condition, participants saw words and provided a fictional story related with each word. In the 'other' condition, these participants listened to recordings of someone else's story for each word. At the end of the first session, participants completed both a digit span task (Wechsler, 1997) to measure working memory and verbal fluency task to measure language abilities (Borkowski et al, 1967) to ensure both groups (AM and Story) did not differ on those measures.

After a 2-day delay, participants were tested on their retention of the words using free recall and recognition paradigms (dependant variables: number of words recalled and number of words correctly recognized). We predicted that the self-reference AM condition would elicit the highest memory accuracy followed by the self-generated story group, the other-reference AM

group and the other-generated story group. These predictions align with previous work done on AM and recall (Warren, Chattin, Thompson & Tomsky, 1983). In addition, we wanted to conduct exploratory work regarding whether there was a relation between the narratives provided and participants later memory performance for the stimuli. We wanted to investigate whether individual differences in the length and completeness of the narratives would influence memory accuracy for the to-be-remembered words.

## Method (Study 1)

### Participants

The final sample included one-hundred and eleven young adults (*M* = 23.44 years, *SD* = 8.87; 65 females, 46 males). Fifty-five young adults were randomly assigned to the AM group (*M* = 23.44 years, *SD* = 8.41; 31 females, 24 males) and fifty-six to the Story group (*M*= 23.45 years, *SD*= 9.36; 34 females, 22 males). An additional fourteen young adults participated in the study, but were not included in the final sample because either they did not show up for the second testing session (*n*=10), the participant did not understand the free recall and recognition tasks during the second session (*n*=1), the participant skipped more than half of the words because they could not come up with memories related with those words (*n*=1), the learning session was not recording (*n*=1) and during the session the participant got distracted because they started speaking with another individual (*n*=1).

Demographic questionnaires revealed that participants were 15.3% White/Caucasian, 36.9% Asian (reported as Chinese, Filipino, Korean, South Asian and West Asian and Southeast Asian), 14.4 Black, African American or African Canadian, 5.4% Latin American, 8.1% Arab and 19.8% other (participants chose that option but did not specify their ethnicity). The reported total family income (Canadian funds) for the final sample was: 7.2% more than $120,000 (high

income), 12.6% between $90,000 and 120,000 (high income), 17.1% between $60,000 and $90,000 (medium income), 19.8% between $40,000 and $60,000 (medium income), 13.5% between $25,000 and $40,000 (low income), 17.1% between $15,000 and $25,000 (low income), 9.9% less than $15,000 (low income) and 2.7% did not report income. Young adult participants were recruited through an online Undergraduate Research Participant Pool (URPP) provided by York University. York University Review Board approved the protocol, and written consent was provided by the participants before they started the first and second sessions. Participants received 1.5 course credits for participating in both sessions one and two.

Participants completed two sessions (via Zoom) separated by an approximately two-day delay, (*M*= 45.30, *SD*= 3.28). All tasks were administered to participants by the same female researcher and both sessions were video and audio recorded for transcription purposes. Our goal was to test 100 participants (50 participants in each group) paralleling past studies (Hamami, Serbun & Gutchess, 2011; Haplin, Puff & Marston, 1984; Cunningham, Quinn, Brebner & Turk, 2014; Sui & Zhu, 2005). Sample size goals were exceeded in the present study.

## Materials

### *Adjectives*

Participants were presented with adjective words selected from Anderson's (1968) 'Likeableness' ratings of 555 personality-traits. See Appendix A for the list of adjective words that were used. Past studies have used Anderson's (1968) rating of adjective words in multiple experimental self-referential paradigms (Turk, Cunningham & Macrea, 2008; Gliksy & Marquie, 2009; Bentley, Greenaway & Haslam, 2017; Maki & McCaul, 1985; Carson, Murphy, Moscovitch & Rosenbaum, 2016; Hamami, Serbun & Gutchess, 2011; Gutchess, Kensinger, Yoon & Schacter, 2007). We chose the adjective words from Anderson's (1968) word bank to

mimic past studies. The inclusion criteria used to determine the list of words taken from Anderson's (1968) word bank included the following; meaningfulness, valence and word length. In Anderson's (1968) word bank, level of meaningfulness was defined as how clear the meaning of each word was. We selected words that were considered high in meaningfulness to ensure participants had a clear and definite understanding of the meaning of the words. The second inclusion criteria was valence, half of the selected words were positive, and half were negative based on Anderson's likeableness ratings. We used the same approach as Glisky & Marquine (2009) and selected the same cut-off rate for valence. A word was considered positive if it was one of the first 252 words listed under the likeability rating and it was negative if it had a likeability rating between 253 and 555. Word length was defined as the mean number of letters in each word (Glisky & Marquine, 2009). A variation of word lengths included a total of two four letter words, two five letter words, two six letter words and two eight letter words.

In the present study, we chose a total of 32 words from Anderson's (1968) word bank. Each condition (baseline, self and other) consisted of eight words and the remaining eight words were used as distractor words in the testing session (see procedure). The number of words included in this study was chosen to mimic past studies and to ensure feasibility of the present study. Previous self-reference studies typically use a range from 16 to 30 words in each condition (Maki & McCaul, 1985; Rogers, Kuiper & Kirker, 1977; Bentley, Greenaway & Haslam, 2017). However, since our study involved more processing tasks and the recall of autobiographical memory narratives (see procedure), it was not feasible to include sixteen words due to study time constraints (our study would have exceeded two hours of testing which was not feasible). Taking these factors into account, we decided to include eight words in each condition to make the tasks more practical while maintaining the task's objective.

The 32 words were randomly divided into four equal lists (e.g., eight words in each list) matched for meaningfulness, valence and word length. Words in the lists (e.g., 24 words) were presented in the memory task learning encoding phase (one list paired with the baseline condition, self condition and other condition). The fourth list was retained for use as distractors in the subsequent memory task during the testing phase (e.g., recognition memory subtask). The order of the words that participants saw in each condition was randomly assigned. The order to which trait lists were assigned to experimental conditions was counterbalanced across participants.

***Recordings of Memories and Stories***

In one of the experimental conditions (see procedure), participants listened to a recording of an 'other' memory or story. See Appendix A for an example of a memory and story recording. These recordings were recorded by a different researcher than the one that administered the tasks during the learning phase. The purpose of having someone else record these stories and memories was to make it sound natural, believable and similar to a real participant as possible.

Since this was a mixed study design where participants were divided into two groups which included the 'AM' and 'Story' groups (each had a baseline, self and other conditions), the length, number of details, and level of imagery in the recorded memories and stories were controlled to make them comparable. The number of details in the memories and stories were the same across all the conditions. For example, although the content differed, we always incorporated information about when the event took place, what happened, who was there and how the characters felt in the memories and stories. To make the stories in the 'Story' group consistent with the memories, minor changes were done such as using fictional character names instead of real names and switching from first person (e.g., "I" or "we") to third person (e.g.,

"she" or "they") point of view. The number of words across all memories and stories consisted of 200 words. To figure out how long the memories and stories should be, we conducted a pilot study on seven participants. Participants were either assigned to the AM group or Story group. They were put into three conditions which included the baseline, self and other. For each condition they were asked to complete specific tasks. Our goal of the pilot study was to calculate the average length of memories and stories participants recalled during the self condition (see procedure). We found that on average the length of their memories and stories were one minute and 20 seconds long. We included one 'other' recording for each word in the AM group and one 'other' recording for each word in the Story group. All the 'other' memories and stories were one minute and 20 seconds long to match the pilot study results.

**Procedure**

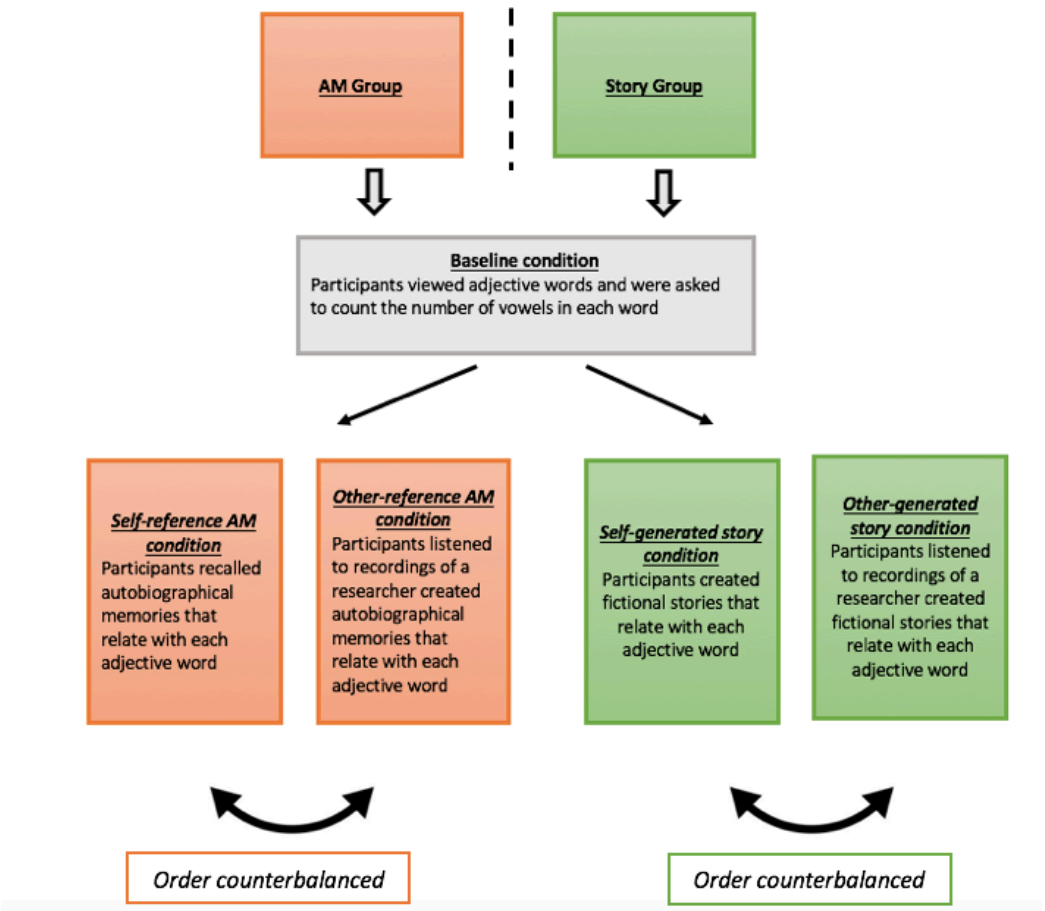
***Overview***

As stated, young adults participated in two sessions separated by two-day delay. In the first session, participants completed the Memory Task 'learning phase', and then completed a digit span task (Wechsler, 1997) and a verbal fluency task (Borkowski et al, 1967). Since this was a mixed study design, for the Memory Task 'learning phase', participants were randomly assigned to either the 'AM' or 'Story' groups, each group had a baseline, self and other conditions. Participants completed the baseline condition first and the order of the other two conditions were counterbalanced (e.g., half of each group experienced the self condition first followed by the other condition; the other half of each group experienced the other condition first followed by the self condition). See Figure 1 and detailed explanation below. In between each of the conditions, participants completed a distractor task which consisted of five math problems. In

the second session, which occurred two days later, participants completed the Memory Task 'testing phase' which consisted of free recall, recognition memory and justification subtasks.

**Figure 1**

*Study 1: Summary of the Groups and Conditions in the Memory Task, Learning Phase*




***Session 1***

**Memory Task Learning Phase.** Session one was conducted online and was administered by a trained researcher. See Appendix B for the experimenter script that was used during the memory task learning phase. The trained researcher used zoom's screen sharing function to show participants the study that was designed and programmed in Qualtrics. All study questions were implemented on that platform.

***AM Group.*** In the AM group, participants were shown different adjectives (e.g., kind) one at time and were asked to complete tasks during the learning phase that varied depending on group assignment. In the AM group, participants completed three conditions which included a baseline condition, self-reference AM condition, and other-reference AM condition (the self-reference AM condition and other-reference AM condition were counterbalanced); See Figure 1 for a summary of the experimental conditions.

*Baseline Condition.* In the baseline condition, participants were provided with the following instructions "You are going to see a word on the screen one at a time. Please verbally indicate the number of vowel(s) each word contains. For example, you will see the word "Energetic" on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to indicate the number of vowel(s) this word contains. The researcher will type your answer in the text box provided. Then you will be directed to the next word. Note that the letter "y" is not considered a vowel. Please do not write down the words." Participants were shown a total of 8 words in this condition. However, before starting this task, all the participants were given a practice question to ensure they understood the task. Participants saw the word "Energetic" on the screen for two seconds and then it disappeared (the word "energetic" was always used in the practice session and was not included in any of the conditions). Then participants were asked to "Please verbally indicate the number of vowel(s) this word contains." The researcher typed the answer the participant said in the text box provided in Qualtrics. The researcher only ended the practice phase once she was certain the participant understood the task. Following the practice phase, testing begun.

*Distractor Task.* In between all the conditions, participants received a distractor task which consisted of five math problems. The math problems all had two parts to them to ensure

the level of difficulty was suitable for young adults (e.g., 5 + 9 - 6). Participants were provided with the following instructions “You are going to see a math problem on the screen one at a time. Please verbally state the answer to the best of your ability. For example, you will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem. Please don’t use a calculator.” The distractor task took one minute to complete (participants had 12 seconds per math problem to state their answer). The purpose of incorporating a distractor task before they moved onto the next experimental condition was to ensure their previous responses did not interfere with the subsequent task.

*Self-Reference AM Condition.* In the self-reference AM condition, participants were presented with 8 words on the screen that appeared one at a time. They were asked to “Please verbally come up with one specific memory that relates with each word. It is very important that the memory is a specific event that you can bring to mind, lasting minutes or hours, but not longer than a day. It’s okay if your memory is from a long time ago or a few days ago. This memory should NOT be about something that happens every day. I want you to tell me WHEN this happened, WHAT happened, WHO was there when it happened and HOW you felt when this happened. For example, you will see the word “Energetic” on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to verbally come up with a memory that relates with the word you saw. You will be asked to provide information about when, what, who and how you felt about the memory you choose. You will then be directed to the next word.” The researcher then presented the word “Energetic” (the word “energetic” was always used in the practice session and was not included in any of the conditions) on the screen for two seconds and after it disappeared the participants saw the prompt “Tell me about your

memory" and underneath it they saw follow-up questions (participants were not required to recall a memory for the example "Energetic"). Participants were told that after each memory they recall, they will be asked the follow-up questions to ensure they provide as many details as possible. Follow-up questions is an interview technique used in the autobiographical memory literature to elicit a complete narrative (Bauer, Burch, Scholin & Güler, 2007; Bauer & Larkina, 2019; Kian, Parmar, Fabiano & Pathman, 2021). For example, the researcher asked whether the participant wanted to add anything new that was not previously stated about "When it happened?" "What happened?" "Who was there?" and "How you felt?" No time constraints were placed on the duration of time participants had to recall each memory. Afterwards, participants completed the same distractor task provided in the baseline condition before they moved onto the next condition.

*Other-Reference AM Condition*. In the other-reference AM condition, participants were presented with eight words that appeared on the screen on at a time. They were asked to "Listen to a recording about another person's specific memory that they came up with that is related with the words. This person is going to tell you WHEN this happened, WHAT happened, WHO was there when it happened and HOW they felt when this happened. For example, you will see the word "Energetic" on the screen for two seconds. It will disappear after the two second duration. You will be asked to listen to someone else's memory that relates with the words you saw. The person will provide information about when, what, who and how they felt about the memory they chose. You will then be directed to the next word." Participants were presented with the word "Energetic" on the screen for two seconds and after it disappeared the participants saw the prompt "Let's listen to their memory." However, since this was an example, no recordings were played. On the same screen, underneath the prompt, participants saw WH follow-up questions

which included “When it happened,” “What happened,” “Who was there,” and “How they felt.” Participants were told they would see the prompt and follow-up questions on the screen as they were listening to the recordings.

***Story Group.*** In the story group, through zoom’s screen sharing function, participants were shown different adjectives (e.g., kind) appear on the screen one at a time and were asked to complete tasks during the Memory Task ‘learning phase’ that different depending on group assignment. In the Story group, participants were also put into three conditions which included a baseline condition, self-reference story condition, and other-generated story condition; See Table 1 for a summary of the experimental conditions.

*Baseline Condition.* Participants completed the same baseline task explained in the AM group and once they were done, they moved onto the next condition.

*Self-Generated Story Condition.* In the self-generated story condition, participants saw 8 words appear on the screen one at a time. They were asked to “Please verbally come up with a fictional story that relates with each word. It is very important that the story you create is all fictional which means that it is NOT related to you in any way. I want you to tell me WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional character felt when this happened. For example, you will see the word “Energetic” on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to verbally come up with a story that relates with the word you saw. You will be asked to provide information about when, what, who and how you felt about the memory you choose. You will then be directed to the next word.” The researcher then presented the word “Energetic” on the screen for two seconds and after it disappeared the participants saw the prompt “Tell me about your story” and underneath it they saw follow-up questions (participants were not required to

recall a story for the example “Energetic”). Participants were told that after each story they recall, they will be asked the follow-up questions to ensure they provide as many details as possible. For example, the researcher asked whether the participant wanted to add anything new that was not previously stated about “When the story takes place?” “What happens in the story?” “Who is in the story?” and “How the characters in the story feel?” No time constraints were placed on the duration of time participants had to recall each story. Afterwards, participants completed the same distractor task previously presented in the baseline condition before they moved onto the next condition.

*Other-Generated Story Condition.* In the other generated story condition, participants were presented with 8 words that appeared on the screen on at a time. They were asked to “Listen to a recording about another person's fictional story that they came up with that relates with the words. This person is going to tell you WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional character felt when this happened. For example, you will see the word “Energetic” on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to listen to someone else's fictional story that relates with the words you saw. This person will provide information about when, what, who and how the fictional characters felt about the story they chose. You will then be directed to the next word.” Participants were presented with the word “Energetic” on the screen for two seconds and after it disappeared the participants saw the prompt “Let’s listen to their story.” No recordings were played since this was an example, but participants did see follow-up questions underneath the prompt. Participants were told they would see the follow-up questions that will be answered within each recording. The follow-up questions included “When the story takes place?” “What

happens in the story?" "Who is in the story?" and "How the characters in the story feel?" Afterwards, participants completed the math distractor task.

**Verbal Fluency Task**. In the verbal fluency task (Borkowski et al, 1967), participants were asked to verbally say all the words they could think of that begin with a certain letter. They were asked to do this task for three different letters which consisted of A, F and C. We decided to select those letters since they are considered "easy" letters and can generate various words (Borkowski, et al., 1967). Participants were told that proper nouns and plural words do not count as words. In previous studies, the duration that participants had to recall the words typically ranged from sixty seconds (Borkowski, et al., 1967), one minute (Benton, 1968) to five minutes (Thurston, 1949). We decided to give participants two minutes per letter which is between one to five minutes taking a less restrictive approach.

**Digit Span Task.** In the digit span task (Wechsler, 1997), participants were asked to complete both a forward order condition and a backwards order condition. In the forward order condition, participants were asked to listen carefully to the researcher say numbers out loud one at a time in each block. After, they were asked to copy the researcher and repeat the numbers back in the same exact way. Two trials were presented per block sequence of the same length. If at least one of these blocks was repeated correctly, the next two trials of a sequence of an increased length was provided to the participant. The test was stopped when the participant failed to reproduce both sequences within the same block correctly. In the backward order condition, participants were asked to do the same task but instead repeat the numbers backwards. Before the test was administered, all the participants were given a practice question to ensure they understood the task. The researcher only ended the practice phase once she was certain the participant understood the task. Following the practice phase, the test was administered.

***Session 2***

**Memory Task Testing Phase.** The same participants completed the testing session where they were tested on all the words they saw during the learning session. See Appendix B for the experimenter script that was used during the memory task testing phase. Participants completed a free recall subtask, recognition memory subtask and justification subtask. This session took approximately 30 minutes to complete.

***Free Recall Subtask.*** Participants always completed the free recall subtask first. They were provided with the following instructions "Please recall all of the words you can remember in any order from the first session." Participants listed as many words as they could remember. The researcher prompted participants with phrases like "Can you remember anything else" once they finished recalling the words to elicit more responses. Responses were audio and video recorded and later transcribed in the exact order they were stated.

***Recognition Memory Subtask.*** Participants completed the recognition memory subtask next. They were told the following "You are going to see a word on the screen one at a time. If you saw the word during the first session, you will verbally say the word "OLD." If you didn't see the word during the first session, you will verbally say the word "NEW." Participants saw a total of 32 words which consisted of 24 "old" words that were presented to them during the first session and eight "new" words that served as distractor words that they did not see during the first session. Before starting this task, participants completed a practice question. Participants saw the word "Energetic" on the screen for two seconds and then it disappeared. After, participants were asked the following question "Please verbally say the word "OLD" if you previously remember seeing the word OR say the word "NEW" if you don't remember previously seeing the word." The researcher typed the answer the participant said in the text box

provided. The researcher only ended the practice phase once she was certain the participant understood the task. Following the practice phase, testing begun.

***Justification Subtask.*** Participants completed this task at the end of the testing session. The justification task consisted of two parts a) to identify whether the word was 'OLD' or 'NEW' after being reminded of the tasks they completed during the first session and b) to provide an explanation for why they identified some words as 'OLD.' The researcher first provided them with the following instructions "During the first session, you completed three tasks: indicated how many vowels each word includes, recalled a specific [memory/story] that relates with each word and listened to a specific [memory/story] that another person came up with that relates with each word. Now, you are going to see a word on the screen one at a time. You will be asked to justify why you thought each word was either "OLD" or "NEW." For example, if you saw the word "Energetic" on the screen you could say that "I think this word was old because I remember I came up with a [memory/story] about my dog that relates with this word." For each word participants identified as 'OLD,' they were asked to justify their answer. If participants said the word was 'OLD' and the justification was that they remembered the word because they recalled a memory or story or heard someone else recall a memory or story, they were asked an additional follow up question. The question was "Can you please tell me what the [memory/story] was about?" This question was asked to identify if participants were able to recall details about the memory/story associated with that word. All their answers were transcribed verbatim. The purpose of asking participants to identify whether each word was 'OLD' or 'NEW' for the second time was to evaluate whether providing them with reminders about the tasks they completed during the first session (e.g., vowel task, recalling a specific memory/story and listening to another person's memory/story) would influence their answers.

Further, we wanted to understand how stable and strong the memory representation was for each word recalled. We also wanted to understand the direction of change for the 'mismatch' word (see scoring section) in each condition. In addition, the purpose of asking participants to provide an explanation as to why they identified words as 'OLD' was to determine which conditions impacted their memory recall the most. This match/mismatch scoring was exploratory and will not be presented in the Results.

**Scoring**

A specific coding scheme was used to code all the documents for the free recall subtask, recognition memory subtask, justification subtask and narratives.

***Memory Task Testing Phase***

**Free Recall Subtask.** For each word the participants recalled correctly they received one point. Incorrect answers were not given a point. Participants that recalled words that were not presented to them during the first session were considered "intrusions" and did not receive any points for those words (see Appendix C for descriptive statistics about the number of intrusions). The dependant variable was the number of correct words in each of the three conditions: the total number of correct baseline words, total number of correct self words and total number of correct other words.

**Recognition Memory Subtask.** We created various sets of scores for each of the three condition. We called one set of scores "hits," another set of scores "misses," and the last set of scores "correct rejection and false alarm."

***Hits.*** A score called "Baseline Hits" was created where participant received one point for each "old" word they correctly identified as "old" that was presented in the baseline condition (see Appendix C for descriptive statistics about AM and Story groups recognition 'hits'). For

example, if the word “kind” was presented to them during the baseline condition (learning session) and they correctly identified it as being “old” during the testing session, they received one point for that word. Another score called “Self Hits” was created where participants received one point for each “old” word they correctly identified as “old” that was presented in the self condition. A score called “Other Hits” was created where participants received one point if they correctly identified an “old” word as being “old” that was presented in the other condition. They received an overall score for each word they were able to identify as seeing in the first session. The highest possible score that participants could have received is a score out of an 8 for each category (e.g., Baseline Hits, Self Hits, etc.).

***Misses.*** A score called “Baseline Miss” was created where participants incorrectly classified an “old” word as “new” in the baseline condition. (see Appendix C for descriptive statistics about AM and Story groups recognition ‘misses’). A score called “Self Miss” was created where participants incorrectly classified an “old” word as “new” in the self condition. A score called “Other Miss” was created where participants incorrectly classified an “old” word as “new” in the other condition.

***Correct Rejection and False Alarm.*** A score called “Correct Rejection” was created where participants that correctly stated a word was “new” when they saw a distractor word (see Appendix C for descriptive statistics about AM and Story groups ‘correct rejection and false alarm’). They received one point for each word they did this for. Another score called “False Alarm” was created where participants identified a “new” distractor word as being “old” and received one point for each word.

**Justification Subtask.** The justification task consisted of asking participants to complete the recognition memory task again. Participants answers were scored using a match versus

mismatch system. To score this section, the 32 words that participants saw during the justification task were put into two categories; matched or mismatched.

*Matched Words.* Words that were allocated in the 'matched' category were words that participants provided the same (matched) answer in the previous recognition memory subtask as well as in the justification subtask. For example, if a participant said the word 'kind' was 'OLD' in the memory recognition subtask and identified it as an 'OLD' word in the justification subtask, then that word was put in the 'matched' category. However, words that were allocated in the 'mismatched' category were words that participants didn't provide the same (mismatched) answer to in the recognition memory subtask and in the justification subtask. For example, if a participant said the word 'kind' was 'OLD' in the memory recognition subtask and identified it as a 'NEW' word in the justification subtask, that word was put in the 'mismatched' category. A total score of matched and mismatched words was obtained after counting the number of words in each category. The total number of matched and mismatched words could tell us how strong the memory representation was. For example, a strong memory representation would have a matching response for both subtasks versus a weaker memory representation could have a mismatching response for both subtasks. To examine this, the 'matched' words were further divided into eight scores. The 'Baseline Correct' score was the number of baseline words participants correctly identified as being 'OLD' in both subtasks. For example, if the word 'kind' was originally seen in the baseline condition and the participant correctly identified it as being 'OLD-OLD' in both subtasks, that word would receive one point. The 'Baseline Incorrect' score was the number of baseline words participant incorrectly identified as being 'NEW' in both subtasks. For example, if the word 'kind' was seen in the baseline condition and the participant incorrectly identified it as being 'NEW-NEW' in both subtasks, that word would receive one

point. The ‘Self Correct’ score was the number of self words participants correctly identified as being ‘OLD’ in both subtasks. For example, if the word ‘kind’ was originally seen in the self condition and the participant correctly identified it as being ‘OLD-OLD’ in both subtasks, that word would receive one point. The ‘Self Incorrect’ score was the number of self words participant incorrectly identified as being ‘NEW’ in both subtasks. For example, if the word ‘kind’ was seen in the self condition and the participant incorrectly identified it as being ‘NEW-NEW’ in both subtasks, that word would receive one point. The ‘Other Correct’ score was the number of other words participants correctly identified as being ‘OLD’ in both tasks. For example, if the word ‘kind’ was originally seen in the other condition and the participant correctly identified it as being ‘OLD-OLD’ in both subtasks, that word would receive one point. The ‘Other Incorrect’ score was the number of other words participants incorrectly identified as ‘NEW’ in both subtasks. For example, if the word ‘kind’ was seen in the other condition and the participant incorrectly identified it as being ‘NEW-NEW’ in both subtasks, that word would receive one point. The ‘Distractor Correct’ score was the number of words participants correctly identified as being ‘NEW’ in both subtasks. For example, if the word ‘kind’ was not seen in the learning session and the participant correctly identified it as ‘NEW’ in both subtasks. The ‘Distractor Incorrect’ score was the number of words participants incorrectly identified as being ‘OLD’ in both subtasks. For example, if the word ‘kind’ was not seen in the learning session and the participant incorrectly identified it as being ‘OLD-OLD’ in both subtasks, that word would receive one point.

*Mismatched Words.* The ‘mismatched’ words were divided into twelve scores. The ‘Baseline Total’ score was the total number of ‘mismatched’ words that were from the baseline condition. The ‘Baseline Correction’ score was the number of words participants said the

incorrect answer during the memory recognition subtask but later when completing the first part of the justification subtask corrected their answer. For example, if a participant said the word 'kind' was 'OLD' during the recognition memory subtask but later changed their response to 'NEW' in the justification subtask, if the correct answer was 'NEW' they would receive one point for the correction they made. The 'Baseline Error' score was the number of words participants said the correct answer during the memory recognition subtask but later when they completed the justification task, they changed their response to the wrong answer. For example, if a participant said the word 'kind' was 'OLD' during the recognition memory subtask but later changed their response to 'NEW' in the justification subtask, if the correct answer was 'OLD' they would receive one point for the error they made. The 'Self Total' score was the number of 'mismatched' responses that were from the self condition. The 'Self Correction' score was the number of words participants said the incorrect answer during the memory recognition subtask but later when completing the first part of the justification subtask corrected their answer. The 'Self Error' score was the number of words participants said the correct answer during the memory recognition subtask but later when they completed the justification subtask, they changed their response to the wrong answer. The 'Other Total' score was the number of 'mismatch' words that were from the other condition. The 'Other Correction' score was the number of words participants said the incorrect answer during the memory recognition subtask but later when completing the first part of the justification subtask corrected their answer. The 'Other Error' score was the number of words participants said the correct answer during the memory recognition subtask but later when they completed the justification subtask, they changed their response to the wrong answer. The 'Distractor Total' score was the number of 'mismatched' words that were from the distractor words. The 'Distractor Correction' score was

the number of words participants said the incorrect answer during the memory recognition subtask but later when completing the first part of the justification subtask corrected their answer. The 'Distractor Error' score was the number of words participants said the correct answer during the memory recognition subtask but later when they completed the justification subtask, they changed their response to the wrong answer.

***Narrative Transcription and Coding***

The autobiographical memory narratives or story narratives that were elicited during session one Memory Task Learning Phase were transcribed verbatim. The narratives elicited by participants during the self-reference AM condition and self-generated story condition were coded for narrative length and narrative breadth. We followed the coding scheme used in Bauer and Larkina, 2014a, 2014b studies. To code for length, one individual parsed all the transcripts into propositional units defined as a unit of meaning that are composed of subject-verb statements. A length score was determined by adding the total number of propositions provided by the participant which reflected how responsive and talkative they were during recall of the memory or generation of the story. A total length score was calculated for all conditions. To estimate the reliability of parsing, 25% of the transcripts were parsed by an independent rater. Intraclass correlation coefficients for parsing was for the narratives was 0.94 and 0.97, respectively.

Narrative breadth was used to measure how complete the narratives were. To code for breadth, we used the WH narrative breadth coding scheme. Narratives were coded for information about (1) who participated in the event (who), (2) the actions involved (what-action), (3) the objects that were involved (what-object), (4) when the event took place (when), (5) where the event took place (where), (6) why the event happened (why), (7) description of physical

elements of the event (how-description), and (8) evaluation of the event (how-evaluation). The first instance of each category was provided with one point. Any repeated information was excluded. For example, if a participant mentioned their sister was at the event (who) multiple times, they received only one point for this category. We gave participants two scores for narrative breath; one score was for 'free recall' and the other score was for 'cued recall.' The 'free recall' breadth score included the first instance participants mentioned one of the WH codes during the time they were asked to recall their memory on their own without the researcher providing them any additional follow up questions. The 'cued recall' breadth score consisted of any additional new WH codes that were mentioned after the researcher provided participants with follow up questions that were not stated in the 'free recall' portion of the interview. The maximum narrative breath score for 'free recall' and 'cued recall' combined was out of eight.

***Verbal Fluency Task***

At the end of the first session, participants completed the verbal fluency task. All the responses were transcribed verbatim in the exact order they were stated. For each word participants stated, they received one point. Responses that included repetitions, proper nouns, plural words, repeated words but with different endings (e.g., eat and eating) and numbers were excluded. We created a score called "total score 1" that included responses for all three letters (e.g., A, F and C) without exclusions for each participant. We further analyzed the "total score 1" responses and further excluded any slang words. We created another score called "total score 2" that included responses from all three letters with exclusions and slang words.

***Digit Span Task***

Participants completed the digit span task during the end of the first session. They were asked to complete a forward order trial and a backward order trial. For both trials, if the

participants sequence of numbers was the same as the experimenters' sequence, they received one point for each correctly repeated sequence of numbers (Borkowski et al., 1967). There was a total of 8 blocks with two sequences in each block (total of 16 sequences). The maximum number of correctly repeated sequence of numbers was 16. Each participant received a "total raw score". For both the forward order and backward order trials, two additional scores were calculated. These included a "forward block span" and "backward block span" and a "forward total score" and "backward total score." The "block span" regardless of forward or backward trials was the length of the last correctly repeated sequence. For example, if a participant correctly repeated all of the numbers in the sequence but incorrectly repeated two sequences in block 6 (the test was stopped if the participant provided two consecutively incorrect sequence of numbers), a count of how many numbers in that sequence was provided (e.g., if the last sequence of numbers was "7, 2, 5, 8, 6" then the "block span" would be "5"). The "total score" regardless of forward or backward trials was the product (multiplication) of the block span and the number of correctly repeated sequences until the test was discontinued (e.g., number of correct trials). For example, if a participant got a "block span" score of a "5" then that would be multiplied with the "total raw score" of correctly repeated sequence until the test was discontinued which could range from 1 to a maximum score of 16 (total number of sequences).

## Results

### Preliminary Analyses

We conducted preliminary analyses to test whether there were any significant differences between the AM and Story groups.

### *Age*

Preliminary analysis was conducted to determine whether there were any differences in age among the two groups. An independent samples *t*-test revealed no differences in age (in years) between the AM and Story groups $t(109) = 0.11$, $p = 0.92$, Cohen's $d = 0.02$.

### *Verbal Fluency Task*

We wanted to test whether there were differences in language ability among the two groups using the verbal fluency task. An independent t-test showed no differences in language ability between both groups for total score 1 $t(109) = -0.16$, $p = 0.86$, Cohen's $d = -0.03$ and total score 2 $t(109) = -0.08$, $p = 0.93$, Cohen's $d = -0.01$.

### *Digit Span Task*

Independent *t*-tests revealed no significant differences in working memory among both groups for the forward block span $t(108) = 1.68$, $p = 0.09$, Cohen's $d = 0.32$ and the forward total score $t(109) = 1.56$, $p = 0.12$, Cohen's $d = 0.29$. Similarly, independent *t*-tests for reverse block span showed no significant differences between both groups $t(109) = 1.03$, $p = 0.30$, Cohen's $d = 0.19$ as well as the reverse total score $t(109) = 1.49$, $p = 0.13$, Cohen's $d = 0.28$.

### *Memory Task Baseline Condition*

We conducted an independent samples *t*-test comparing the baseline results for both AM and Story groups. We found no significant differences in the number of correct baseline words recalled for both groups $t(108) = -0.93$, $p = 0.35$, Cohen's $d = -0.17$. We also found no difference between AM and Story groups in baseline recognition scores, $t(109) = -0.14$, $p = 0.88$, Cohen's $d = -0.02$.

Paired samples t-test were conducted to test how baseline compared to the primary conditions of interest on *free recall subtask* memory performance (number of correct words

recalled). We report Cohen's *d* for paired *t* test effect sizes (see recommendations and calculator provided by Lakens, 2013). Paired t-tests revealed a significant difference between baseline and self conditions in the AM group $t(54) = -11.05$ $p < 0.001$, Cohen's $d = -1.49$ and Story group $t(54) = -9.94$ $p < 0.001$, Cohen's $d = -1.34$. There was also a significant difference between baseline and other conditions in the AM group $t(54) = -6.28$, $p < 0.001$, Cohen's $d = -0.84$ and Story group $t(54) = -7.56$, $p < 0.001$, Cohen's $d = -1.02$. Table 1 shows that participants' performance in the baseline condition was always lower than the self and other conditions in both the AM and Story groups.

**Table 1**

*Descriptive Statistics for Free Recall Subtask*

| Response Type | AM Group | | Story Group | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Baseline | 0.05 | 0.22 | 0.11 | 0.36 |
| Self | 2.78 | 1.72 | 1.89 | 1.30 |
| Other | 1.02 | 1.13 | 1.31 | 1.18 |

*Note.* This table shows the number of words correctly recalled for each condition for both groups in the free recall subtask.

We conducted paired samples t-test to test the conditions on memory performance among the AM and Story groups in the *recognition subtask*. Paired t-tests found a significant difference between the baseline and self conditions in the AM group $t(54) = -19.06$, $p < 0.001$, Cohen's $d = -2.57$ and Story group $t(55) = -17.42$, $p < 0.001$, Cohen's $d = -2.32$. We also found a significant difference between the baseline and other conditions in the AM group $t(54) = -10.15$, $p < 0.001$,

Cohen's $d$ = -1.37 and Story group $t(54)$ = -10.27, $p < 0.001$, Cohen's $d$ = -1.37. Therefore, participants' performance was always lower in the baseline condition in comparison with all conditions of interest (self AM, other AM, self story, other story).

**Table 2**

*Descriptive Statistics for Recognition Subtask*

| Response Type | AM Group | | Story Group | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Baseline | 2.42 | 1.67 | 2.46 | 1.67 |
| Self | 7.29 | 0.93 | 7.18 | 1.09 |
| Other | 5.49 | 1.67 | 5.09 | 1.81 |

*Note.* This table shows the number of 'hits' for each condition for both groups in the recognition subtask.

**Primary Analyses**

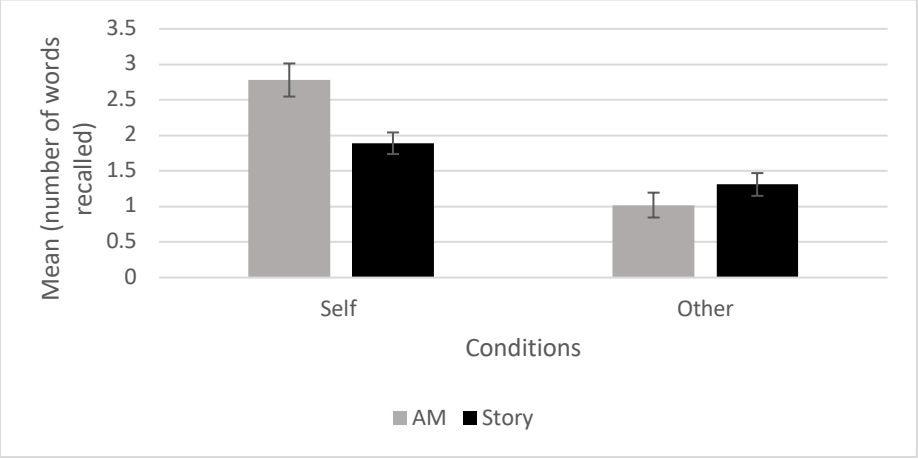
***Free Recall Subtask***

A repeated measures analysis of variance (ANOVA) was conducted to test the conditions on memory performance (number of words recalled) in the free recall task. The dependent variable was the number of correct words recalled and the independent variables were self-involvement (within subjects: 'self' and 'other' conditions) and generation type (between subjects: AM or Story groups). We found a main effect of conditions, $F(1, 108)= 34.81$, $p= .0001$, $\eta_p^2= .24$. Across groups, accuracy for the self condition was higher than in the other condition. There was also an interaction effect, $F(1, 108)= 8.83$, $p= .004$, $\eta_p^2 = .07$. To follow up the interaction effect, paired t-tests were conducted for the 'self' and 'other' conditions. There was a significant difference

between groups for the self condition $t(108)= 3.05$, $p = 0.003$, Cohen's $d = 0.58$ but there was no difference between groups for the other condition $t(108) = -1.31$, $p = 0.19$, Cohen's $d = - 0.25$. As shown in Figure 2, we found that memory performance (recalled more words) was higher for the self condition in the AM group (e.g., "tell me about a memory that relates with the word") compared to the Story group (e.g., "create a fictional story that relates with the word"). However, there were no difference between groups in memory recall in the other condition. Therefore, when we associate our personal memories with words we find a boost in memory performance (recall more words) which suggests that coming up with memories ourselves is more meaningful as it can enhance our retention of words in comparison with when we come up with fictional stories that are not related to us. Moreover, both the AM and Story groups in the self condition are better than 'other.'

**Figure 2**

*Free Recall Subtask Mean Accuracy*



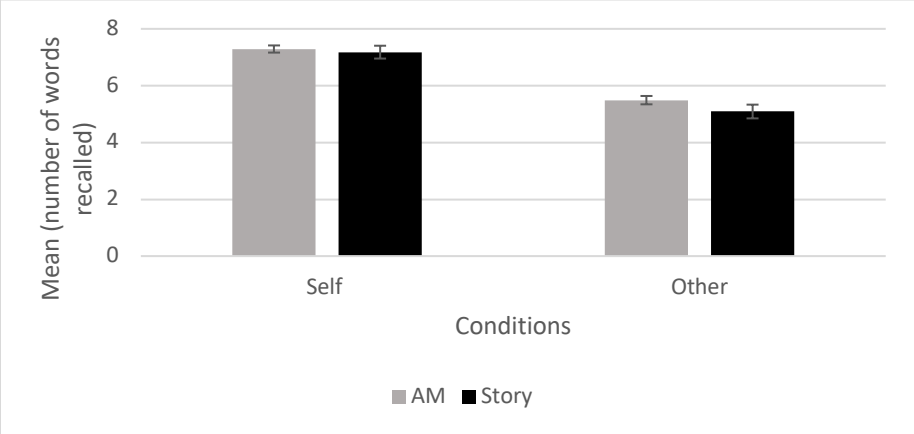

*Note.* Mean accuracy for each condition for each group. Error bars represent ± SE.

***Recognition Memory Subtask***

We conducted a repeated measures ANOVA analysis to compare the conditions in the recognition memory task. Again, we examine generation type and self-involvement. The dependent variable was the number of words correctly identified as old (i.e., hits) and the independent variables were the groups (AM or Story) and conditions (self and other). There was a main effect for the 'self' and 'other' conditions, $F(1, 109)= 99.59$, $p = 0.001$, $\eta_p^2 = 0.47$. Across groups, there were more hits for the 'self' condition than the 'other' condition. However, there was no interaction effect, $F(1, 109)= 0.55$, $p = 0.46$, $\eta_p^2 = 0.005$. As shown in Figure 3, we found no differences between the AM and Story groups. This could suggest that when participants were asked to recognize the words (OLD vs NEW), generating a story was just as good as generating a memory.

**Figure 3**

*Recognition Subtask Mean Accuracy*




*Note.* Mean accuracy for each condition for each group. Error bars represent ± SE.

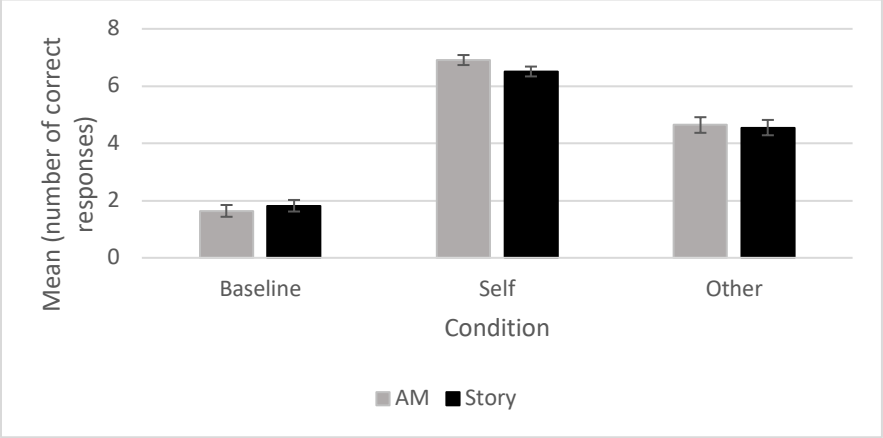
***Exploratory Analyses: Justification Subtask***

Exploratory analyses were conducted to examine whether participants were able to provide the correct justification of the source each word was attributed to during the 'Memory Task

Learning Phase.' A repeated measures ANOVA was conducted to test the how many of the justification responses participants correctly identified the source. The dependent variable was the number of correct responses in each condition (baseline, self and other) and the independent variables were the groups and conditions. There was main effect for condition, $F(2, 106)= 298.58$, $p= .0001$, $\eta_p^2= 0.73$. However, there was no interaction effect between responses and groups, $F(2, 106)= 0.98$, $p = 0.37$, $\eta_p^2 = .009$. Post hoc analyses were conducted using Bonferroni correction, we found the baseline condition ($M= 1.73$, $SD= 1.49$) was significantly lower than the self condition ($M= 6.70$, $SD= 1.28$) and other condition ($M= 4.59$, $SD= 1.98$). Figure 4 shows that participants provided the least correct justification responses in the baseline condition. Differences were found in the self and other conditions. In the self condition, participants provided the most correct justification responses followed by the other condition.

**Figure 4**

*Justification Subtask Mean Accuracy Correct Responses*



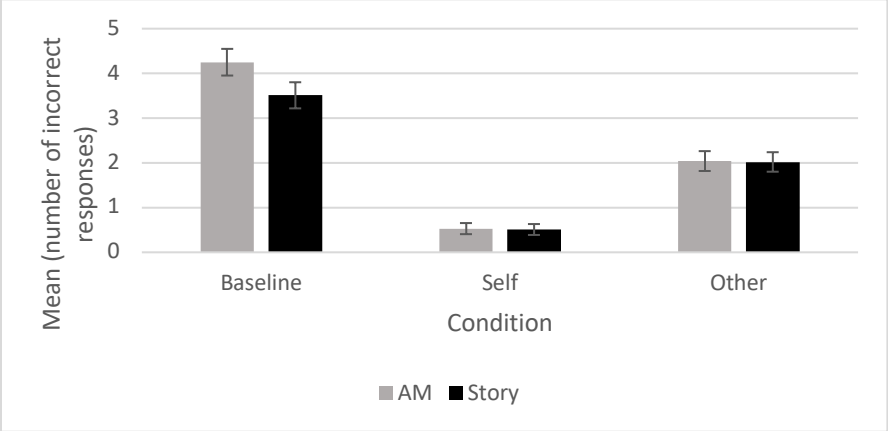

*Note.* Mean accuracy for each condition for each group. Error bars represent ± SE.

A repeated measures ANOVA was conducted to test the how many of the justification responses participants incorrectly identified the source. The dependent variables were the number of incorrect responses in each condition (baseline, self and other) and the independent variables

were the groups and conditions. There was main effect for responses, $F(2, 106)= 136.99$, $p= .0001$, $\eta_p^2= 0.56$. However, there was no interaction effect between responses and groups, $F(2, 106)= 2.07$, $p = 0.128$, $\eta_p^2 = .019$. Pairwise comparisons were conducted using Bonferroni post hoc analyses which revealed the baseline condition ($M= 3.87$, $SD= 2.18$) was significantly higher than the self condition ($M= 0.52$, $SD= 0.90$) and other condition ($M= 2.03$, $SD= 1.60$). Figure 5 shows that participants provided more incorrect justification responses when identifying the source of the word in the baseline condition. However, there were differences between the self and other conditions. Participants provided the least amount of incorrect responses in the self condition followed by the other condition.

**Figure 5**

*Justification Subtask Mean Accuracy Incorrect Responses*




*Note.* Mean accuracy for each condition for each group. Error bars represent ± SE.

***Exploratory Analyses: Autobiographical Memory Narratives***

We conducted correlational analyses to examine whether participants narrative length and narrative breadth in their episodic AM's led them to retain more words (e.g., adjectives) during the free recall and recognition memory tasks. It is important to note that these analyses only contain the narrative scores of the first word for each participant. The results provide a snapshot of how

the narrative length and breadth impacted their memory performance of the words in the free recall and recognition scores.

***Relations between Narrative Length and Free Recall Subtask***

Narrative length refers to the number of propositional units produced by the participant. The correlation analysis was conducted for both AM and Story groups. In the AM group, there were no significant correlations between narrative length and number of correct words recalled for the baseline condition $r(53) = .072$, $p = .600$, self condition $r(53) = .166$, $p = .227$, and other condition $r(53) = -.223$, $p = .102$. In the Story group, we also found no significant correlation between the total proportion score and number of correct words in the during the free recall task in the baseline condition $r(53) = -0.12$, $p = .365$ and other condition $r(53) = .059$, $p = .667$. However, there was a significant correlation in the self condition $r(53) = .276$, $p = .042$. This suggests that participants who generated a longer story related to particular words, recalled more of the words in the self condition. To be conservative, it is important to note that with Bonferroni correction, this correlation is no longer significant.

***Narrative Length for Recognition Memory Subtask***

In the AM group, there were no significant correlations between the narrative length and number of correct hits during the recognition memory task in the baseline condition $r(53) = .185$, $p = .176$, self condition $r(53) = .199$, $p = .146$ and other condition $r(53) = .029$, $p = .836$. Same patterns were found in the Story group (all $p$s $> 0.05$).

***Narrative Breadth for Free Recall Subtask***

Narrative breadth refers to how complete the participant's narratives were during the interview session. Two scores for narrative breadth were 'free recall' and 'cued recall.' The correlation analysis was conducted for both groups. In the AM group, there were no significant

correlations between the 'free recall' narrative breadth score and baseline condition $r(53) = -.112$, $p = .418$, self condition $r(53) = -.030$, $p = .829$ and other condition $r(53) = -.024$, $p = .862$. In the Story group, there were also no significant correlations between the 'free recall' narrative breadth score and the baseline condition $r(53) = -.001$, $p = .995$, self condition $r(53) = .014$, $p = .917$ and other condition $r(53) = -.034$, $p = .804$. We conducted additional correlation analyses for the 'cued recall' scores for both groups. In the AM group, we found no significant correlation between the 'cued recall' narrative breadth free recall score and baseline condition $r(53) = -.112$, $p = .418$, self condition $r(53) = .016$, $p = .906$ and other condition $r(53) = .024$, $p = .862$. Similarly, in the Story group, we found no significant correlation between the 'cued recall' narrative breadth score and baseline condition $r(53) = -.169$, $p = .217$, self condition $r(53) = -.091$, $p = .509$ and other condition $r(53) = .003$, $p = .981$.

***Narrative Breadth for Free Recall Recognition Subtask***

In the AM group, there were no significant correlations between the 'free recall' narrative breadth score and recognition hits score in the baseline condition $r(53) = .134$, $p = .329$, self condition $r(53) = .006$, $p = .965$ and other condition $r(53) = .013$, $p = .926$. In the Story group, there was no significant correlations between the 'free recall' narrative breadth score and recognition hits score in the baseline condition $r(53) = -.163$, $p = .229$, self condition $r(53) = -.107$, $p = .432$ and other condition $r(53) = -.032$, $p = .812$. We conducted additional correlation analyses for the 'cued recall' scores for both groups. In the AM group, we found no significant correlation between the 'cued recall' narrative breadth recognition score in the baseline condition $r(53) = -.117$, $p = .395$, self condition $r(53) = .040$, $p = .771$ and other condition $r(53) = .098$, $p = .476$. In the Story group, we found no significant correlation between the 'cued recall' narrative breadth

recognition score in the baseline condition $r(53) = .121$, $p = .373$, self condition $r(53) = .016$, $p = .904$ and other condition $r(53) = -.192$, $p = .156$.

***Partial Correlations for Narrative Breadth in the Free Recall Subtask***

We conducted partial correlations, controlling for narrative length (e.g., propositional score). We wanted to examine whether narrative length influenced the results found in narrative breadth free recall and recognition scores. No significant correlations relations were found. Therefore, performance was not related with narrative breadth.

## Discussion

The purpose of the present study was to examine whether episodic autobiographical memory during learning of adjective words can help enhance memory of those words. Specifically, we examined how retrieving episodic AMs during encoding of stimulus material (self AM) compared with other types of novel encoding strategies, to examine which boosts memory of adjective words the most. Young adults completed a 'memory task learning phase' and 'memory task testing session' separated by a two-day delay. Participants were divided into two groups: the AM group and Story group. Each group took part in 'baseline,' 'self,' and 'other' conditions. During the memory task learning session, participants were shown different adjective words (e.g., calm) one at time in each condition and asked to complete tasks that varied depending on group assignment. Participants also completed a verbal fluency task and digit span task at the end of the learning session. During the memory task testing session, participants were tested on their retention of the words using free recall, recognition and justification methods.

We found that memory performance was higher for all four experimental conditions (AM group-self, AM group-other, Story group-self, Story group-other) compared to baseline where participants were asked to count the number of vowels in each word. This is expected because

participants were not deeply encoding the material due to the superficial nature of the task. Since the baseline task was processed in a shallow way, there was no memory advantage. Furthermore, in the free recall subtask, recall of words was higher for AM group-self than Story group-self conditions. However, we found no differences in memory recall between AM group-other and Story group-other conditions. Thus, retrieving a past AM during new learning led to the highest recall; it was also higher than generating a fictional story. We also found that listening to another person's AM during encoding led to similar levels of recall as listening to another person's fictional story. Our findings are consistent with existing literature conducted on the self-reference effect suggesting that associating words (e.g., adjectives, nouns, etc.) with the 'self' leads to a memory advantage of those words in comparison with associating those words with the 'other' (e.g., experimenter) or in a 'superficial' way (e.g., counting number of vowels) (Maki & McCaul, 1985; Serbun, Shih & Gutchess, 2011; Gutchess, Kensinger, Yoon & Schacter, 2007; Yin, Ma, Xu & Yang, 2019; Cunningham, Scott, Hutchinson, Ross & Martin, 2018). This finding could be due to our understanding that retention of information heavily depends on the amount of elaboration that is provided during the encoding phase (Anderson & Reder, 1979). Since the 'self' involves multiple rich and personally relevant information, it can create a richly elaborated memory trace (Keenan & Baillet, 1980; Rogers et al., 1977).

Similarly, associating adjective words with the 'self' by providing episodic AM's gives participants an additional advantage of retrieval procedure since it generates a number of different cues. However, no comparable retrieval cues occurs when the adjective words are processed for their superficial features, and they are not deeply encoded. Furthermore, the finding that participants recalled more words for the AM group-self condition than the Story group-self condition suggests differences occurring not only in the self condition but between

groups as well (AM and Story). Another explanation could be that emotional valence of stimuli can influence how information is organized and encoded in one's self-relevant network. Studies that examined memory for emotional information (e.g., trait adjectives, autobiographical memories, etc.) suggest that participants could be more compelled and motivated to associated positive rather than negative information with the 'self' and remember it better to preserve a positive self-image of themselves (Comblain, D'Argembeau, & Van der Linden, 2005; Sedikides & Green, 2000).

In the recognition subtask, we found no difference between AM and Story groups which could suggest that when participants are asked to recognize the words (OLD vs NEW task), generating a story is just as good as generating a memory. It could be that using an OLD/NEW recognition memory paradigm was perceived as a little bit of an easier task since participants were reminded of the words and they had to identify whether it was OLD or NEW (the correct answer). One explanation as to why this occurred could be explained by the "dual-process signal detection model" (DPSD) (Yonelinas, 1994). There has been a consensus that recognition memory is promoted by DPSD (Wixted, 2007a; Parks & Yonelinas, 2007a, 2007b). In this model, familiarity is thought to reflect a signal detection process where memory strength of to-be-remembered material is temporarily increased causing individuals to pick the most familiar items as having been recently studied (Yonelinas, 1994; Yonelinas, 2002; Yonelinas and Parks, 2007). Since participants were provided with cues (e.g., presented with the adjective words they saw during the learning session), it could be possible that they were relying on how familiar they felt each word was from the last time they saw them. This familiarity process was equally effective for recognizing self AM and self Story groups.

The majority of studies conducted on the self-reference effect mainly focused on free recall and recognition testing paradigms, however, few studies further investigated source memory for specific features of events (e.g., details about the encoding task) (Kim & Johnson, 2012; Leshikar & Duarte, 2012; Hamami, Serbun, Shih & Gutchess, 2011; Kahan & Johnson, 1992). Accurately retrieving internal source information (e.g., drawing on AM's) could suggest that memories have been encoded with more associated detail than memories that do not have information about the source (Johnson & Raye, 1981). Our study incorporated a 'justification subtask,' which is unique. We found that when participants tried to justify their response by linking it to the encoding task (source), participants provided the least correct justification responses in the baseline condition compared to the self and other conditions which provided significantly more correct responses. Our results are not surprising given our previous discussion regarding the 'self' and 'other' (see Introduction). When the to-be-remembered material is encoded using the 'self,' it has a memory advantage than information provided by the 'other.' This finding is supported in the literature. For example, one study using trait adjectives as stimuli asked participants at encoding to judge if trait adjectives were self-descriptive, commonly encountered, or presented in uppercase letters (Hamami et al., 2011). Later, participants were asked to complete a source memory task where they identified which encoding condition the word had been presented in or whether the word was new. Participants demonstrated better source identification for words encoded self-referentially in comparison to memory for other encoding conditions. This shows that self-referencing manipulation can be particularity effective for encoding source details of verbal memories. According to the Source Monitoring Framework (Johnson et al., 1993), encoding information in a self-referential way should be beneficial for source memory when the processes engaged during encoding bind features to items which can

later be used as cues to correctly identify the source. For example, during encoding, participants in our study generated self AM's which include a specific self-relevant association (e.g., "the word 'happy' reminds me of when my sister was born"), this could be activated during retrieval and confirm that the item was processed in a self-referential way. This could explain our finding in the justification subtask.

Lastly, we conducted exploratory analysis on whether participants who recalled longer or more complete episodic AM's retained more adjective words. We found that those who came up with longer narratives for the AM group for all conditions did not necessarily recall more words during the free recall and recognition testing subtasks. Since the previous literature suggests that the slightest introduction of associating stimuli (e.g., adjective words, nonsense words, etc.) with the self can show the self-reference effect (Cunningham, Scott, Hutchinson, Ross & Martin, 2018; Peynircioglu, 1989; Bower & Gilligan, 1979) it could be that the length of AM's is not the driving force in this effect (does not greatly impact participants capacity of retrieval) (Turk, Cunningham & Macrae, 2008). For example, Cunningham et al (2011) examined the relationship between self and agency where participants completed an ownership task that involved either viewing or choosing objects for themselves or others. The element of personal choice created a better memory bias for self-owned objects than when ownership was provided by the experimenter. In addition, in the same study, they found that even when participants made their choice blindly (e.g., selecting numbers on a grid that are associated to items they received), higher performance was attributed to perceived self-agency over the items. Therefore, it seems that once a memory is retrieved or generated in the participant's mind, further elaboration is not needed. Our findings have implications in education as educators could potentially focus on encouraging students to make self-referential associations with to be learned stimuli but spend

less time asking students to elaborate on their self-experiences. On the contrary, our preliminary analysis on whether narrative length leads to higher recall of adjective words showed a significant difference in the Story group only for the 'self' condition. This suggests that participants who generated a longer story related to particular words, recalled more of those words.

Here we compared retrieving episodic AM's with other strategies and found that associating our personal memories with new learning led to the highest boost in memory performance. We replicated previously robust findings, but also contributed new knowledge and extended past work. However, there are a few limitations to note and several avenues for future research based on the present study. First, the time that participants had to process the adjective during the learning phase could be controlled in a future study. In the present study, participants spent less time during the baseline condition (counting vowels) in comparison with the self and other conditions (e.g., recalling a memory/story or listening to someone else's memory/story). A future study could extend the duration of time spent during the baseline condition, to better match this condition to the other experimental conditions.

Second, the recorded 'other' memories and stories were created in a way that represented what a 'perfect' narrative would typically entail. For example, a detailed and rich narrative would include a longer memory/story, various details (responses to all WH questions), and high level of imagery. Our made up 'other' memories and stories included all these elements which is beneficial. However, this could have potentially altered our results since participants had a lot of details to encode in the 'other' condition as it was controlled. However, the number of details in the 'self' condition (generating a memory or story themselves) varied depending on individual differences between participants. This is not to say that our results are not warranted, however, our results

provide insight about how individuals would respond to the 'other' rich and detailed memories and stories. Future studies could use a more naturalistic approach when formulating the 'other' stimuli by using real-life memories and stories that other participants had previously recalled.

Third, due to time constraints, we focused on testing one specific age group. It would be interesting to examine younger age groups, such as school-age children and middle-age children, to gain insights regarding developmental differences. Studies on the self-reference effect have been conducted on younger children (Cunningham, Brebner, Quinn & Turk, 2014; Cunningham, Vergunst, Macrae & Turk, 2013; Sui & Zhu, 2005; Ross et al., 2009), however, it would be interesting to directly compare younger children to young adults as it could provide us with a better understanding regarding the developmental trajectory that occurs when examining the novel learning strategy discussed in the present study.

Fourth, in order to tease apart the 'self' from the 'generation' of a memory, it would be interesting to include another condition where participants are asked to retrieve a memory that happened to someone else. In other words, the participant could retrieve an event that they did not participate in themselves, but heard about occurring to someone else they know. For example, the participant could recall a memory of their mom telling them something that happened to her during her childhood. An alternative condition would be for the participant to listen to a recording of someone else recalling a memory about the participant. One way to do this is for the researcher to ask a parent or close relative of the participant to recall events the participant had experienced. These additional conditions could extend the current study's findings by further exploring why the self-reference AM condition was so beneficial (test the importance of the self compared to memory generation of this condition). Although these additional conditions would not be practical in the classroom setting, it could be used to extend the theoretical literature.

Lastly, our study included a two-day delay period between ‘memory task learning phase’ and ‘memory task testing phase.’ However, future studies should incorporate a longer delay period (e.g., two weeks). This would provide us with more knowledge about whether encoding material while relating it with an AM or story in the ‘self’ or ‘other’ conditions can be retained over longer periods of time. Future work examining longer delay period could inform educators that plan to use this learning strategy about the longevity of the effect.

Additional research comparing different learning strategies in a novel and unique way is needed as the results could have educational implications. Educators in the classroom could enhance their method of teaching as they could explicitly inform students about the importance of focusing on the ‘self’ when encoding information. Our results show that enhanced memory performance was higher for the ‘AM group-self' condition compared with the other conditions. Future studies could provide participants with to-be-remembered material typically taught in a particular subject matter in school (e.g., facts about plants that could be taught in a biology class) and examine whether encoding that information using the same encoding paradigm used in this present work would impact their memory performance. This could provide educators with insight regarding which learning strategy is most effective and should be utilized and promoted within the classroom.

## Appendix A

**List of adjective words used:**

Warm
Lazy
Loyal
Timid
Prompt
Lonely
Truthful
Insecure
Kind
Cold
Happy
Moody
Honest
Silent
Friendly
Restless
Neat
Alert
Clever
Cheerful
Rude
Noisy
Clumsy
Critical
Tidy
Mean
Witty
Angry
Polite
Untidy
Trustful
Gullible

**Recording script for 'other' condition**

**Example of one AM memory recorded by someone else: adjective word is 'warm'**

I remember when I was 17 years old I went to Florida with my sister Lindsey to go see Disney World. I remember this happened on July, 2016. When we got to Florida the first thing I could think of was how beautiful it was. I knew I was going to enjoy my time. I remember we stayed there for one week because we wanted to go on all of the rides and see all of the cool shows at

Disney World. When we were walking to all of the different rides and shows, I remember sweating so much because it was so **warm** outside! I felt the heat and all I wanted to do was drink water and take breaks between rides and shows. I remember my sister and I bought Disney themed water bottles and we kept refilling them every 10 minutes. I am not even joking, it was that bad! I remember so many people were doing the same thing. Me, my sister Lindsey and a few other people that we didn't know were surrounding the water refill area. I remember feeling so frustrated because of the weather and the long line up near the water fountain.

**Example of one fictional story recorded by someone else: adjective word is 'warm'**

There was a girl named Sally and when she was 17 years old she went to Florida with her sister Lindsey to go see Disney World. Sally remembers this happened on July, 2016. When Sally got to Florida the first thing she could think of was how beautiful it was. Sally knew she was going to enjoy her time. Sally and her sister stayed there for one week because they wanted to go on all of the rides and see all of the cool shows at Disney World. When they were walking to all of the different rides and shows, Sally remembers sweating so much because it was so **warm** outside! Sally felt the heat and all she wanted to do was drink water and take breaks between rides and shows. Sally and her sister bought Disney themed water bottles and they kept refilling them every 10 minutes or so. It was that bad! Sally saw so many people were doing the same thing. Sally, her sister Lindsey and a few other people that they didn't know were surrounding the water refill area. Sally felt so frustrated because of the weather and the long line up near the water fountain.

## Appendix B

**Script experimenter used when providing participants with instructions in the Story group (same script was used for the AM group but the word "story" was substituted with "AM"):**

First session script:

This Zoom call is going to be recorded just so we can go back and review what you said. In the consent form, did you agree to allow me to record this meeting? Perfect! Thanks for confirming.

**BASELINE CONDITION**

Let's start with the first task. You are going to see a word on the screen one at a time. Please verbally indicate the number of vowel(s) each word contains.

For example: You will see the word "Energetic" on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to indicate the number of vowel(s) this word contains. The researcher will type your answer in the text box provided. Then you will be directed to the next word.

Note: The letter "y" is considered a vowel.

Let's practice on the next slide before we start.

Please verbally indicate the number of vowel(s) this word contains.

The real task will start on the next slide. Please verbally indicate the number of vowel(s) each word contains. Note: The letter "y" is considered a vowel.

**MATH DISTRACTOR TASK #1**

You are going to see a math problem on the screen one at a time.

Please verbally state the answer to the best of your ability.

For example: You will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem.

Let's start.

**STORY GROUP- SELF CONDITION**

You are going to see a word on the screen one at a time.

Please verbally come up with a fictional story that relates with each word.

It is very important that the story you create is all fictional which means that it is NOT related to you in any way.

I want you to tell me WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional character felt when this happened.

For example: You will see the word "Energetic" on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to verbally come up with a story that relates with the word you saw. You will be asked to provide information about when, what, who and how you felt about the memory you choose. You will then be directed to the next word.

Next I would ask you to provide me information about the following things:

1. Please tell me when this happened.
2. Please tell me what happened.
3. Please tell me who was there when this happened.
4. Please tell me how you felt when this happened.

The real task will start on the next slide.

Please verbally come up with one fictional story that relates with each word.

**MATH DISTARACTOR TASK #2**

You are going to see a math problem on the screen one at a time.

Please verbally state the answer to the best of your ability.

For example: You will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem.

Let's start.

**STORY GROUP- OTHER CONDITION**

You are going to see a word on the screen one at a time.

After, you are going to listen to a recording about another person's fictional story that they came up with that relates with the words.

This person is going to tell you WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional character felt when this happened.

For example: You will see the word "Energetic" on the screen for two seconds. It will disappear after the two second duration. After, you will be asked to listen to someone else's fictional story that relates with the words you saw. This person will provide information about when, what, who and how the fictional characters felt about the story they chose. You will then be directed to the next word.

Next you are going to listen to another person provide information about the following things:

1. Please tell me when this happened.
2. Please tell me what happened.
3. Please tell me who was there when this happened.
4. Please tell me how you felt when this happened.

The real session will start on the next slide.

Please listen carefully to recordings about another person's fictional storythat they came up with that relates with each word.

**MATH DISTRACTOR TASK #2**

You are going to see a math problem on the screen one at a time.

Please verbally state the answer to the best of your ability.

For example: You will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem.

**DIGIT SPAN TASK**

Digit Span Task Instructions- PART 1

We are going to play a fun game with numbers. I am going to say some numbers. Listen carefully, and when I am done, say them right after me. So, you will copy me and say it the exact same way. I will let you know when I am done so you know it is your turn.

Digit Span Task Instructions- PART 2

We are going to play the same game. However, this time I want you to repeat the numbers after me but I want you to say them backwards.

**VERBAL FLUENCY TASK**

Please verbally say all of the words you can think of that begin with a certain letter. You will be asked to do this task for 3 different letters. Proper Nouns and Plural words do NOT count as words. You will have 2 minutes per letter.

Please tell me all of the words you can think of that begin with the letter A
Please tell me all of the words you can think of that begin with the letter F
Please tell me all of the words you can think of that begin with the letter C

Thank you for participating during this first session. I will see you again for the second session. Once you complete the second session, you will then be awarded all of your credits (total of 1.5).

Second session script:

**FREE RECALL TASK**

Please recall all of the words you can remember in any order from the first session. [Tester follows-up for more responses until participant is done: *Can you tell me more?*].

**RECOGNITION TASK**

You are going to see a word on the screen one at a time. If you saw the word during the first session, you will verbally say the word "OLD." If you didn't see the word during the first session, you will verbally say the word "NEW."

Let's practice on the next slide before we start.

Click the next red arrow and the word “energetic” will appear.

Is this “OLD” or “NEW?”

The real task will start on the next slide.

Please verbally say the word "OLD" if you previously remember seeing the word OR say the word "NEW" if you don't remember previously seeing the word.

**JUSTIFICATION QUESTIONS**

During the first session, you completed three tasks:

1. Indicated how many vowels each word includes.

2. Recalled a specific memory that relates with each word.

3. Listened to a specific memory that another person came up with that relates with each word.

Now, you are going to see a word on the screen one at a time.

You will be asked to justify why you thought each word was either "OLD" or "NEW."

For example: If you saw the word "Energetic" on the screen you could say that "I think this word was old because I remember I came up with a memory about my dog about this word."

Let’s start.

Thank you for participating in both session 1 and 2. You will be granted course credit for both sessions shortly.

# Appendix C

**Table C1**

*Study 1 Free Recall Subtask: Number of Intrusions Descriptive Statistics*

| Group | AM | | Story | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| | 0.95 | 1.12 | 0.91 | 1.04 |

**Table C2**

*Study 1: AM Recognition Hits and Misses Descriptive Statistics*

| AM Group | Hits | | Misses | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Baseline | 2.41 | 1.68 | 5.59 | 1.68 |
| Self | 7.29 | 0.93 | 0.71 | 0.93 |
| Other | 5.49 | 1.67 | 2.51 | 1.67 |

**Table C3**

*Study 1: Story Recognition Hits and Misses Descriptive Statistics*

| Story Group | Hits | | Misses | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Baseline | 2.44 | 1.67 | 5.56 | 1.67 |
| Self | 7.16 | 1.10 | 0.84 | 1.10 |
| Other | 5.09 | 1.82 | 2.91 | 1.82 |

**Table C4**

*Study 1 Recognition Subtask: Correct Rejection and False Alarm Descriptive Statistics*

| Group | Correct Rejection | | False Alarm | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| AM Group | 6.78 | 1.28 | 1.22 | 1.28 |
| Story Group | 6.76 | 1.23 | 1.24 | 1.23 |

## Abstract (Study 2)

Learning strategies are techniques that students can use to help them absorb, store, and retrieve to-be-learned information to optimize learning and retention. Past studies have investigated learning strategies such as the self-reference effect or generation effect. Some of these studies examined whether a memory advantage exists when retrieving episodic AMs or generating information during encoding of stimulus material (self AM) compared to listening to someone else's episodic AM (other AM) or generating information. However, relatively few past studies have used to-be-tested stimuli that closely resembles material taught in the classroom. Here, we compared learning strategies such as retrieving an episodic autobiographical memory (AM) or generating a fictional story narrative related to the to-be-remembered stimuli that closely resembled classroom material. Young adults ($N$= 107) completed two sessions separated by a two-day delay. Participants were divided into two groups: AM group and Story group. Each group learned novel facts in conditions that differed in encoding task: baseline (count the number of times they saw the word "they" in each fact), self (relate fact to their own memory/story) and other (listen to someone else's memory/story that relates with the fact). Later, participants were tested on their retention of the facts using free recall and recognition subtasks. Memory performance was higher for all four experimental conditions compared to baseline. In the free recall subtask, we found no differences in recall between the self and other conditions in the AM group. However, the self condition in the Story group was higher than the other condition. Furthermore, we found that recall of the facts was higher for the self condition in the Story group than in the AM group. In the recognition subtask, there was no difference between AM and Story groups. Overall, the results could inform educators regarding which learning strategies are most beneficial and increase memory performance.

## STUDY 2

Imagine yourself sitting in a grade eleven biology class learning about living creatures. During the lesson, you find yourself encoding material by taking detailed notes and maintaining focus throughout class. After the lesson, your friend tests you on the material you just learned to find out how many facts you were able to retain. Unfortunately, you were able to recall fewer facts than you had predicted. When you ask your teacher for an explanation as to why this occurred, it turns out that you could have used more robust encoding or learning strategies. Learning strategies are techniques or thought processes that students can use to help them absorb, organize, store, and retrieve to-be-learned information to optimize learning and retention (Dunlosky, Rawson, Marsh, Nathan & Willingham, 2013). Educators encourage their students to utilize learning strategies within the classroom to better enhance overall performance. In the scenario described above, you learned that you could have potentially recalled more facts had you used learning strategies that are known to be robust.

Dissertation Study 1 examined whether episodic autobiographical memory (AM) during learning of adjective words can help boost memory performance of those words. We investigated whether a memory advantage exists when retrieving episodic AMs during encoding of stimulus material (self AM) compared to listening to someone else's episodic AM (other AM). Specifically, the same comparisons were made while asking participants to come up with fictional stories (self-generated story) or listening to someone else (other-generated story) come up with these stories. The results showed that memory performance was higher for all 4 experimental conditions (AM self, AM other, story self, story other) compared to the baseline condition which required participants to encode material in a superficial way (counting the number of vowels in the to-be-learned words). Recall of words was higher for the 'self' conditions than the 'other' conditions

overall. Within the self condition, retrieving AM led to higher memory performance (e.g., recalled more words) than generating a story during encoding. There was no difference between 'AM' and 'Story' for the two 'other' conditions. Therefore, retrieving a past AM during new learning led to the highest recall. We also found that listening to another person's AM during encoding led to similar levels of recall as listening to another person's fictional story. Overall, these findings are intriguing and extend past work on the self-reference effect (relating study material to oneself boosts memory) and generation effect (generating study material boosts memory) in novel ways. It should be noted, however, that the stimuli that was used (e.g., adjective words) could be manipulated to make them more applicable to the classroom (e.g., facts).

The majority of past papers that have investigated different encoding strategies related to the self-reference effect or generation effect, like dissertation Study 1 used simple lab-based stimuli that does not closely resemble material used in the classroom, such as lists of arbitrary adjectives (Klein & Kihlstorm, 1986; Rogers, Kuiper & Kirker, 1977; Klein, Burton & Loftus, 1989), nouns (Maki & McCaul, 1985; Czienskowski & Giljohann, 2002; Warren, Chattin, Thompson & Tomsky, 1983), trait words (Carroll & Davis, 2001) and pictures of faces or objects (Cunningham, Vergunst, Macrae & Turk, 2013; Cunningham, Brebner, Quinn & Turk, 2014; Sui & Zhu, 2005). Relatively few studies have used to-be-tested material that closely resembles material taught in the classroom (e.g., class textbook material: Hartlep & Forsyth, 2000; spelling words: Turk et al., 2015 Study 2; prose passages: Reeder, McCormick & Esselman, 1987). Examining stimuli that is relevant and closely related with realistic material taught in the classroom can have educational implications. This information could provide educators with information regarding which learning strategies are most beneficial and increase memory performance. Educators could gain insight into the strategies that should be utilized and promoted within the

classroom. In the present study, we examined the same unique encoding strategies used in dissertation Study 1. However, instead of using adjective words as the to-be-remembered information, we used novel facts about novel creatures that participants had never seen before. The to-be-tested material about the novel creatures were developed to ensure that we were testing participants on information that closely resembled material (e.g., short lesson) that could be taught in a classroom setting. Therefore, facts were curated while maintaining the degree of complexity that could be closely aligned with course material (e.g., facts included multiple different details).

Young adults completed two sessions (via Zoom) separated by a 2-day delay. Participants were divided into two groups: the AM group and Story group. Each group took part in 'baseline,' 'self,' and 'other' conditions. For both groups, in the 'baseline' condition, participants saw three facts pertaining to one novel creature and counted the number of times they saw the word "they" in each fact. In the AM group, 'self' condition, participants saw three facts about a different novel creature, and they were asked to provide one past memory that is related with each fact. In the 'other' condition, these participants listened to recordings of someone else's memory for each fact. In the Story group, 'self' condition, participants saw three facts about a novel creature and provided a fictional story related with each fact. In the 'other' condition, these participants listened to recordings of someone else's story for each fact. After a two-day delay, participants were tested on their retention of the novel facts using free recall and recognition paradigms. We predicted that the self-reference AM condition would elicit the highest memory accuracy followed by the self-generated story group, the other-reference AM group and the other-generated story group.

## Method (Study 2)

### Participants

The final sample included one-hundred and seven young adults ($M$ = 20.44 years, $SD$ = 3.79; 66 females, 41 males). Fifty-six young adults were randomly assigned to the AM group ($M$ = 19.96 years, $SD$ = 2.79; 37 females, 20 males) and fifty-one to the Story group ($M$ = 20.96, $SD$ = 4.62; 30 females, 21 males). An additional twenty-four young adults participated in the study, but were not included in the final sample because either they did not show up for the second testing session ($n$= 19), the participant got disconnected from the first session due to weak internet connection ($n$= 1), participants got distracted with other work and left the meeting early ($n$= 2), the participant did not follow task instructions during the memory free recall subtask ($n$=1) and the researcher did not record the session ($n$= 1).

The ethnicity of the final sample of participants included 15.74% White/Caucasian, 44.45% Asian (reported as Chinese, South Asian and West Asian, Filipino, and Southeast Asian), 10.19% Arab, 11.11% Black, African American, or African Canadian, 4.63% Latin American and 13.88% Other (did not specify). The reported total family income (Canadian funds) for the final sample were as follows: 14.81% more than $120,000 (high income), 13.89% between $90,000 and 120,000 (high income), 15.73% between $60,000 and $90,000 (medium income), 17.59% between $40,000 and $60,000 (medium income), 11.11% between $25,000 and $40,000 (low income), 18.52% between $15,000 and $25,000 (low income), 7.41% less than $15,000 (low income) and 0.94% did not report income. Young adult participants were recruited through an online Undergraduate Research Participant Pool (URPP) provided by York University. York University Review Board approved the protocol, and written consent was obtained by each participant before

they started the first session. Participants received 1.5 course credits for participating in both sessions.

Participants completed two sessions (via Zoom) separated by an approximately two-day delay period, (*M*= 44.08 hours, *SD*= 2.71). All tasks were administered by the same female researcher in Study 1 and both sessions were video and audio recorded for transcription purposes. Minimum sample size goals were based on past studies that have conducted research on the self-reference effect in young adults (Bower & Gilligan, 1979; Haplin, Puff, Mason & Marston, 1984; Gutchess, Kensinger, Yoon & Schacter, 2007; Carroll, Robert & Martin, 2001; Hamami, Serbun & Gutchess, 2011). Our goal was to test 100 participants (50 participants in each group) to match the sample size in Study 1. Sample size goals were exceeded in the present study.

**Materials**

***Creatures and Facts***

Participants were presented with three facts about each of the three made-up (e.g., non-existent) creatures they had never seen before (e.g., "Ranzer", "Bambal", etc.). See Appendix A for the list of facts for each novel creature. To-be-learned stimuli were creatures created by experimenters (as opposed to existing animals) so that participants would not have any prior knowledge about the animals or facts to be tested. The facts were created to be comparable across all creatures. They were organized into three broad categories which included description, habitat and food (see subsection 'Scoring' below). The number of details in each category was the same for all the creatures to make it consistent and comparable. For example, the "description" category for each creature included six unique details, the "habitat" category included four details and the "food" category included five details. Each detail was unique to the creature and there were no repetitions of the same detail. For example, if details in the "description" category were about a

creature called the Ranzer and they were “miniscule insects”, both words ‘miniscule’ and ‘insects’ were not repeated for another creature. The facts pertaining to each condition were randomly assigned. For example, if the animal called the Ranzer was placed in the first condition (e.g., baseline condition) for participant A, participant B saw it in the third condition (e.g., ‘other’ condition).

***Pictures of Novel Creatures***

Participants were presented with a picture of each creature that was accompanied with each fact. See Appendix A for the pictures of the novel creatures. The creatures were created by modifying pictures of real animals using an online website called Adobe Photoshop that manipulated certain features of the original photo (e.g., crop certain physical features, change colour, shrink and enlarge certain areas, etc.). Each creature looked physically distinct from one other. In addition, a different made-up name was assigned to each created as well (e.g., Ranzer, Linkert and Bambals). Pilot testing was done to finalize the set of creatures/pictures (e.g., if a proposed creature/picture reminded pilot participants of an existing animal, it was not used).

***Recordings in ‘Other’ Conditions***

In one of the experimental conditions (see procedure), participants listened to a recording of an ‘other’ memory or story recorded by the same voice of the actor that recorded content in Study 1. See Appendix A for an example of a story and memory recording. The length, number of details, and level of imagery in the memories and stories were controlled to make them comparable. To control for these elements, we conducted a pilot study on six participants. We calculated the average length of the memories and stories the participants recalled. The average length was three minutes and thirty seconds. We made all the ‘other’ memories and stories approximately three minutes and thirty seconds long to match the pilot study results. The pilot

study results showed that the number of words across all memories and stories was approximately 500 to 600 words. Therefore, all the memories and stories recorded for the 'other' conditions consisted of approximately 500 to 600 words. The number of details included in the memories and stories recorded were the same across all conditions. For example, although the content differed, we still included information about when the event took place, what happened, who was there and how the characters felt in the memories and stories. To make the stories in the 'Story' group consistent with the memories, minor changes were made such as using fictional character names instead of real names and switching from first person (e.g., "I" or "we") to third person (e.g., "she" or "they") point of view. The level of imagery was also consistent throughout the memories and stories. Recordings were constructed such that not one memory or story was more interesting than the other. Moreover, the memories and stories consisted of the same narrative structure which included an exposition, rising action, climax, falling action and conclusion. Lastly, valence was also considered such that half of the memories and stories were negative, and half were positive.

## Procedure

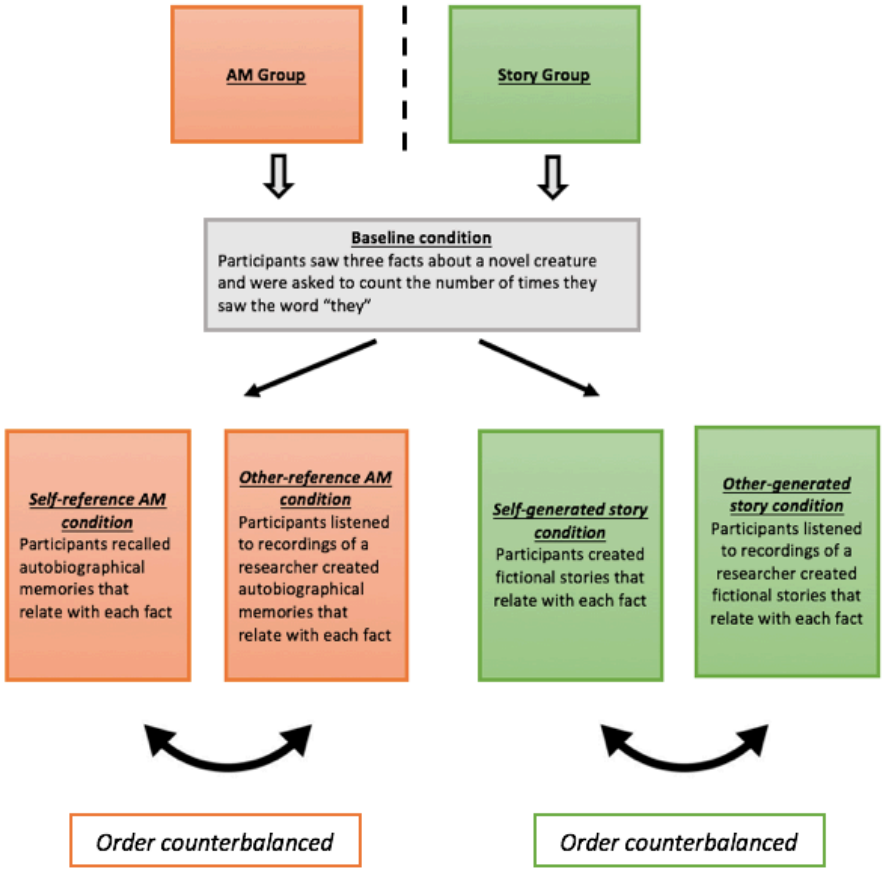
### *Overview*

Like Study 1, young adults participated in two sessions separated by a 2-day delay. In the first session, participants completed the Memory Task 'learning phase.' During the Memory Task 'learning phase', participants were randomly assigned to either the 'AM' or 'Story' groups, each group had a baseline, self and other conditions. Participants completed the baseline condition first and the order of the other two conditions were counterbalanced. See Figure 1 and detailed explanation below. In between each condition, participants completed the same math distractor task in Study 1. In Session 2, participants first completed the Memory Task 'testing phase' which consisted of free recall, recognition memory and justification subtasks and after were administered

the digit span task (Wechsler, 1997) and a verbal fluency task (Borkowski et al, 1967). For the purposes of the present study, the results of the justification subtask were not further examined (approved by supervisory committee).

**Figure 1**

*Study 2: Summary of the Groups and Conditions in the Memory Task, Learning Phase*




***Session 1***

**Memory Task Learning Phase.** Session one was conducted online via zoom and was administered by the same trained researcher in Study 1 (see Appendix B for the experimenter script that was used during the Memory Task learning phase). Zoom's screen sharing option was used to

show participants the study which was developed in Qualtrics. All study questions were implemented on that platform.

***AM Group.*** In the AM group, participants were shown pictures of different creatures with corresponding facts and were asked to complete tasks during the Memory Task 'learning phase,' that differed depending on group assignment. In the 'AM' group, participants completed three conditions which included a baseline condition, self-reference AM condition, and other-reference AM condition; See Figure 1 for a summary of the experimental conditions. All conditions were counterbalanced.

*Baseline Condition.* In the baseline condition, participants were provided with the following instructions "You are going to see three facts about the creature appear on the screen one at a time while listening to an audio recording of each fact. You will see each fact again for 45 seconds. During this time, I would like you to please count the number of times the word "they" appears in each fact. I will then ask you to please verbally indicate the number of times that word appeared. After, you will listen to each fact again without doing anything." Before participants completed the task, they were provided with an example which stated, "For example, you will see the fact "People that have braces still need to floss because if they don't, they will have issues in the future." After, you will see the fact again for 45 seconds and then you will be asked to indicate the number of times you saw the word **"they"** in that fact. The researcher will type your answer in the text box provided. Then you will listen to the same fact again and then you will be directed to the next fact. Please don't write down the facts." Participants saw a total of three facts about a creature in this condition. However, before starting this task, participants were provided with a practice question to ensure they understood the task. Participants saw the fact "People that have braces still need to floss because if they don't, they will have issues in the future" on the screen for

45 seconds and then it disappeared. Participants were asked to "Please verbally indicate the number of times the word "they" appeared." The researcher typed the answer the participant said in the text box provided. The practice phase ended once the researcher was certain the participant understood the task. Following the practice phase, testing begun.

*Distractor Task.* In between each of the conditions, participants received the same math distractor task that was administered in Study 1. Participants were provided with the same instructions, and they had a total of 12 seconds to answer a total of five math problems.

*Self-Reference AM Condition.* In the self-reference AM condition, participants were presented with a total of three facts about a particular creature that appeared on the screen one at a time. Participants were told "You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact. You will see each fact again for 45 seconds. During this time, please verbally come up with one specific memory that relates with each fact. It is very important that the memory is a specific event that you can bring to mind, lasting minutes or hours, but not longer than a day. It's okay if your memory is from a long time ago or a few days ago. This memory should NOT be about something that happens every day. I want you to tell me WHEN this happened, WHAT happened, WHO was there when it happened and HOW you felt when this happened. After, you will listen to each fact again without doing anything. Please don't write the facts down." After, participants were provided with an example to ensure they understood the task. They saw the same example (the fact about needing to floss when wearing braces) presented during the baseline condition which appeared on the screen for 45 seconds and after it disappeared. The participant saw a prompt that stated, "Tell me about your memory" and underneath it were the follow-up questions (participants did not provide memories for this example). Participants were told that after each memory they recall, they were asked follow-up questions. For example, the

researcher asked whether the participant wanted to add anything new that was not previously stated about "When it happened?" "What happened?" "Who was there?" and "How you felt?" Like Study 1, there were no time constraints for how long participants had to recall each memory. Lastly, participants completed the math distractor task before they moved onto the next condition.

*Other-Reference AM Condition.* In the other-reference AM condition, participants were provided with three facts about a different creature that appeared on the screen one at a time. They were provided with the following instructions "You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact. You will see each fact again for 45 seconds. After, you are going to listen to a recording about another person's specific memory that they came up with that relates with each fact. When describing their memory they will state WHEN this happened, WHAT happened, WHO was there when it happened and HOW they felt when this happened. After, you will listen to each fact again without doing anything." Participants were provided with the following example "For example, you will see the fact "People that have braces still need to floss because if they don't, they will have issues in the future." After, you will see the fact for 45 seconds and then you will be asked to listen to someone else's memory that relates with the fact you saw. You will listen to the same fact again and then be directed to the next fact. Please don't write the facts down." Participants completed a practice session where they saw an example on the screen for 45 seconds and after it disappeared participants saw the prompt "Let's listen to their memory." However, since this was a practice session, no recordings were played but participants did see follow-up questions underneath the prompt. They were told "You are going to listen to another person provide information about the following things: please tell me when this happened, please tell me what happened, please tell me who was there when this happened and how you felt when this happened." Afterwards, participants completed the math distractor task.

***Story Group.*** In the Story group, participants were shown different creatures with corresponding facts and were asked to complete tasks during the Memory Task 'learning phase' that differed depending on group assignment. In the Story group, participants were also put into three conditions which included a baseline condition, self-generated story condition, and other-generated story condition; See Table 1 for a summary of the experimental conditions.

*Baseline Condition.* Participants completed the same baseline task that was administered in the AM group and once they were done, they moved onto the next condition.

*Self-Generated Story Condition.* In the self-generated story condition, participants saw three facts about a particular creature appear on the screen one at a time. They were told "You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact. You will see each fact again for 45 seconds. During this time, please verbally come up with a fictional story that relates with each fact. It is very important that the story you create is all fictional, which means that it is NOT related to you in any way. I want you to tell me WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional character felt when this happened. After, you will listen to each fact again without doing anything." For example: You will see the fact "People that have braces still need to floss because if they don't, they will have issues in the future." After, you will see the fact for 45 seconds and then you will be asked to verbally come up with a story that relates with the fact you saw. You will listen to the same fact again and then be directed to the next fact." Participants completed a practice session where they saw an example prompt on the screen for 45 seconds and then it disappeared. After, participants saw a prompt that stated, "Tell me about your story" and underneath it were the follow-up questions (participants did not provide stories for this example). Participants were told they will be asked follow up questions as well. For example, the researcher asked whether the participant

wanted to add anything new that was not previously stated about “When it happened?” “What happened?” “Who was there?” and “How you felt?” After, participants completed the same distractor task before moving on to the next condition.

*Other-Generated Story Condition.* In the other-generated story condition, participants were told “You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact. You will see each fact again for 45 seconds. After, you are going to listen to a recording about another person's fictional story that they came up with that relates with each fact. When describing their story, they will state WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional characters felt when this happened. For example, you will see the fact “People that have braces still need to floss because if they don't, they will have issues in the future.” After, you will see the fact for 45 seconds and then you will be asked to listen to someone else's fictional story that relates with the fact you saw. You will listen to the same fact again and then be directed to the next fact. Please don't write the facts down.” After, participants completed a practice session where they saw the same example prompt on the screen for 45 seconds and then it disappeared. After, participants saw a prompt that stated, “Let’s listen to their story” and underneath it were the follow-up questions (participants did not listen to any stories in the practice session). Participants were told they would see the follow-up questions that will be answered within each recording. The follow-up questions included “When the story takes place?” “What happens in the story?” “Who is in the story?” and “How the characters in the story feel?” After, they completed the math distractor task.

***Session 2***

**Memory Task Testing Phase.** The same participants completed the second session where they were tested on all the facts they learned about during the first session (see Appendix B for the

experimenter script that was used during the Memory Task testing phase). Participants completed a free recall subtask, recognition memory subtask and justification subtask. For the purposes of the present study, the justification subtask will not be examined. This session took approximately 30 minutes to complete.

***Free Recall Subtask.*** All participants completed the free recall subtask first. They were provided with the following instructions "In the previous session you learned about novel creatures and facts about these novel creatures. Please tell me everything you can remember." Participants recalled as many facts and details as they could remember (no time restrictions were provided). Once participants stopped recalling their responses, the researcher prompted participants with phrases like "Can you remember anything else" or "Can you tell me more" to elicit more responses. Responses were written down during the session and were also audio and video recorded and later transcribed in the exact order they were stated.

***Recognition Memory Subtask.*** Participants completed the recognition memory subtask last. They were provided with the following instructions "You are going to answer multiple choice questions about the novel creatures you learned about during the first session. Please make sure to read the questions carefully and verbally tell me the correct answer." Before they started the task, participants completed a practice question. The practice question was "What do people who have braces still need to do to prevent issues in the future?" The options that participants chose from included floss, visit the dentist or use an electric toothbrush. The correct answer was "floss." Once participants provided the correct answer to the question, the recognition memory subtask was administered. However, if participants selected the wrong answer, they were provided with the correct answer and the researcher repeated the instructions again to make sure they understood the task. The researcher only ended the practice phase once all participants understood the task.

Following the practice phase, the task was administered. Each question appeared on the screen one at a time. Seven multiple choice questions were presented for each of the three creatures. Therefore, participants were asked a total of 21 multiple choice questions. A total of three questions were about the description of the creature, two questions were about the habitat and two questions were about the food the creature eats. Each question consisted of five options that participants got to select from. Three of the options were from the three creatures the participants saw during the first session and the other two options were distractors. All the questions and options were randomized. If the participant did not know the answer to the question, they were asked to provide the best answer they had.

**Word Fluency Task.** At the end of the second session for both groups, participants were asked to complete the same word fluency test (Borkowski et al, 1967) to measure their language abilities that was administered in Study 1.

**Digit Span Task.** At the end of the second session for both groups, participants were administered the same digit span task (Wechsler, 1997) to measure their working memory that was administered in Study 1.

**Scoring**

A specific coding scheme was used to code all the documents for the free recall and recognition memory subtasks. Participants' narratives (e.g., memories or stories) were not examined or coded in the present study.

***Memory Task Testing Phase***

**Free Recall Subtask.** We created a standard scoring sheet that explicitly specified how participants received points for the free recall subtask. The scoring sheet organized all the facts into three broad categories which included description, habitat and food. The number of details in

each category was the same for all the creatures. The scoring sheet consisted of a total score for each category. Specifically, if the participant recalled information about the animal's description, they received one point for recalling each of the following details: classification of the animal (e.g., miniscule), size of the animal (e.g., insects), colour of the animal (e.g., black), texture of the animal (e.g., shells), detail of a body part of the animal (e.g., round), and body part (e.g., eyes). For example, if the "description" category for the Ranzer (name of the creature) consisted of six details, a participant could receive a maximum score out of a six or lower for that category. Similarly, if they recalled information about the animal's habitat, they would receive one point for recalling each of the following details: living area (e.g., dark places), example of habitat (e.g., caves), temperature (e.g., freezing climates), and country (e.g., Switzerland). For example, if the "habitat" category for the Ranzer consisted of five details, a participant could receive a maximum score out of a five or lower for that category. Lastly, if they recalled information about the animal's food, they would receive one point for recalling each of the following details: four types of food they eat (e.g., leaves, beetles, dragonfly and crickets) and the animal's favourite food (e.g., wasps). The maximum score participants could have received for the "description" category is a six, for the "habitat" category is a four and "food" category is a five. Participants could have received a total maximum overall score of 15 points for all of the three broad categories. Therefore, participants could have received a maximum score out of 15 points in each condition (baseline, self and other).

**Recognition Memory Subtask.** Participants responses to the multiple-choice questions were marked as either "correct" or "incorrect." If they chose the correct response, they received one point. If they chose the incorrect response, they did not receive any point (e.g., zero). An overall score for each of the conditions (e.g., baseline, self and other) was calculated by counting the number of correct responses each participant got. They also received a 'total score' that

combined the baseline, self and other conditions. This score was out of 21 points (total number of multiple questions).

### *Verbal Fluency Task*

At the end of the second session, participants completed the verbal fluency task. All the responses were transcribed verbatim in the exact order they were stated. For each word participants stated, they received one point. Responses that included repetitions, proper nouns, plural words, repeated words that had different endings (e.g., eat and eating) and numbers were excluded. We created a score called "total score 1" that included responses for all three letters (e.g., A, F and C) without exclusions for each participant. We further analyzed the "total score 1" responses and further excluded any slang words. We created another score called "total score 2" that included responses from all three letters with exclusions and slang words.

### *Digit Span Task*

Participants completed the digit span task during the end of the second session. They were asked to complete a forward order trial and a backward order trial. The same scoring scheme that was used in Study 1 was used for the present study. For both trials, if the participants sequence of numbers was the same as the experimenters' sequence, they received one point for each correctly repeated sequence of numbers (Borkowski et al., 1967). There was a total of 8 blocks with two sequences in each block (total of 16 sequences). The maximum number of correctly repeated sequence of numbers was 16.

## Results

### Preliminary Analyses

We conducted preliminary analyses first to examine whether any significant differences existed between the AM and Story groups.

### *Age*

Preliminary analysis was conducted to determine whether there were any differences in age among the two groups. An independent samples *t*-test revealed no differences in age (in years) between the AM and Story groups $t(106) = -1.32$, $p = 0.18$, Cohen's $d = -0.25$.

### *Verbal Fluency Task*

Preliminary analysis was conducted to examine whether there were any differences in language abilities between the two groups using the verbal fluency task. An independent t-test showed no differences in language ability between both groups for total score 1 $t(105) = -1.29$, $p = 0.19$, Cohen's $d = -0.25$ and total score 2 $t(105) = -1.23$, $p = 0.22$, Cohen's $d = -0.23$.

### *Digit Span Task*

We conducted independent t-tests which revealed no significant differences in working memory among both groups for the forward block span $t(104) = 0.86$, $p = 0.38$, Cohen's $d = 0.16$ and the forward total score $t(104) = 1.04$, $p = 0.29$, Cohen's $d = 0.20$. Similarly, independent t-tests for reverse block span showed no significant differences between both groups $t(104) = 0.40$, $p = 0.68$ Cohen's $d = 0.07$ as well as the reverse total score $t(104) = 0.83$, $p = 0.40$, Cohen's $d = 0.16$.

### *Memory Task Baseline Condition*

We conducted an independent samples *t*-test comparing the baseline condition memory performance for both AM and Story groups. We found no significant differences in the number of correct baseline words recalled for both groups $t(105) = 0.51$, $p = 0.61$, Cohen's $d = 0.99$. We also found no difference between AM and Story groups in baseline condition recognition scores, $t(106) = -1.03$, $p = 0.30$, Cohen's $d = -0.19$.

Paired samples t-test were conducted to test how baseline compared to the primary conditions of interest on *free recall subtask* memory performance (number of correct words recalled). We report Cohen's *d* for paired *t* test effect sizes (see recommendations and calculator provided by Lakens, 2013). Paired t-tests revealed a significant difference between baseline and self conditions in the AM group $t(56) = -5.95$, $p < 0.001$, Cohen's $d = -0.78$ and Story group $t(49) = -8.10$, $p < 0.001$, Cohen's $d = -1.14$. There was also a significant difference between baseline and other conditions in the AM group $t(56) = -6.83$, $p < 0.001$, Cohen's $d = -0.90$ and Story group $t(49) = -6.03$, $p < 0.001$, Cohen's $d = -0.85$. Table 1 shows that participants' performance in the baseline condition was lower than the self and other conditions in both the AM and Story groups.

**Table 1**

*Descriptive Statistics for Free Recall Subtask*

| Response Type | AM Group | | Story Group | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Baseline | 0.63 | 1.19 | 0.52 | 1.05 |
| Self | 2.28 | 1.84 | 3.50 | 2.55 |
| Other | 2.47 | 1.97 | 2.46 | 2.21 |

*Note.* This table shows the number of facts correctly recalled for each condition for both groups in the free recall subtask.

We conducted paired samples t-test to test the conditions on memory performance among the AM and Story groups in the *recognition subtask*. Paired t-tests found a significant difference between the baseline and self conditions in the AM group $t(56) = -4.13$, $p < 0.001$, Cohen's $d = -0.54$ and Story group $t(50) = -4.07$, $p < 0.001$, Cohen's $d = -0.57$. We also found a significant

difference between the baseline and other conditions in the AM group $t(56) = -4.17$, $p < 0.001$, Cohen's $d = -0.55$ and Story group $t(50) = -3.63$, $p < 0.001$, Cohen's $d = -0.50$. Table 2 shows participants' performance was lower in the baseline condition in comparison with all conditions of interest (self AM, other AM, self story, other story).

**Table 2**

*Descriptive Statistics for Recognition Subtask*

| Response Type | AM Group | | Story Group | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| Baseline | 1.91 | 1.72 | 2.25 | 1.71 |
| Self | 3.47 | 2.32 | 3.71 | 2.38 |
| Other | 3.14 | 2.04 | 3.41 | 1.99 |

*Note.* This table shows the number of answers correctly identified for each condition for both groups in the recognition subtask.

**Primary Analyses**

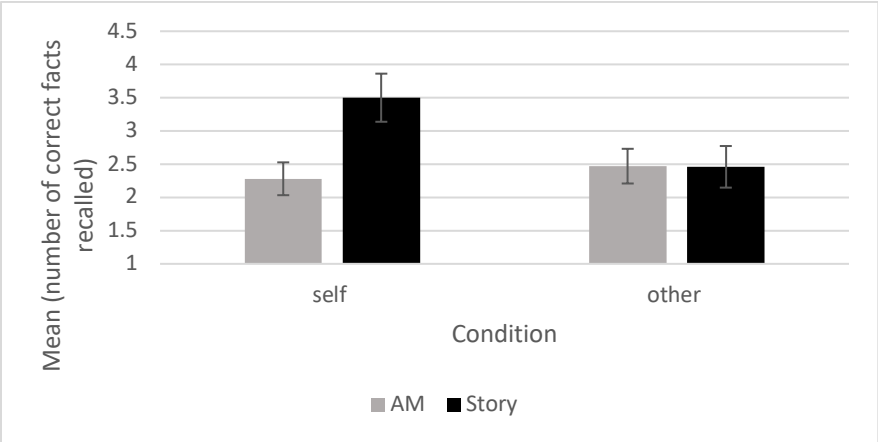
***Free Recall Subtask***

A repeated measures analysis of variance (ANOVA) was conducted to test the primary conditions of interest on memory performance (number of facts recalled) in the free recall task. Specifically, we examined the a) generation type (AM vs. Story groups) and b) self-involvement (self vs. other conditions). The dependent variable was the number of correct facts recalled and the independent variables for the within subjects factor were the 'self' and 'other' conditions and for the between subjects factor were the AM or Story groups. We did not find a main effect of conditions, $F(1, 105) = 2.25$, $p = 0.13$, $\eta_p^2 = .021$. However, there was an interaction effect, $F(1,$

105)= 4.77, $p$= .03, $\eta_p^2$= .043. To follow up the interaction effect, paired t-tests were conducted for the conditions. There was no significant difference between scores for the self and other conditions for the AM group, $t(56)$= - 0.55, $p$= 0.58, Cohen's $d$ = -0.07, but there was a significant difference between scores for the self and other conditions for the Story group, $t(49)$= 2.30, $p$= 0.026, Cohen's $d$= 0.32. As shown in Figure 2, we found that memory performance (recalled more facts) was higher for the self condition in the Story group (e.g., "tell me about a fictional story that relates with the fact") $t(105)$= -2.85, $p$ = 0.00, Cohen's $d$ = -0.52, than in the AM group (e.g., "tell me about a memory that relates with the fact") $t(105)$= 0.34, $p$= 0.97, Cohen's $d$= 0.00. However, there were no differences in memory recall in the other condition for both the AM and Story groups.

**Figure 2**

*Free Recall Subtask Mean Accuracy*




*Note.* Mean accuracy for each condition for each group. Error bars represent ± SE.

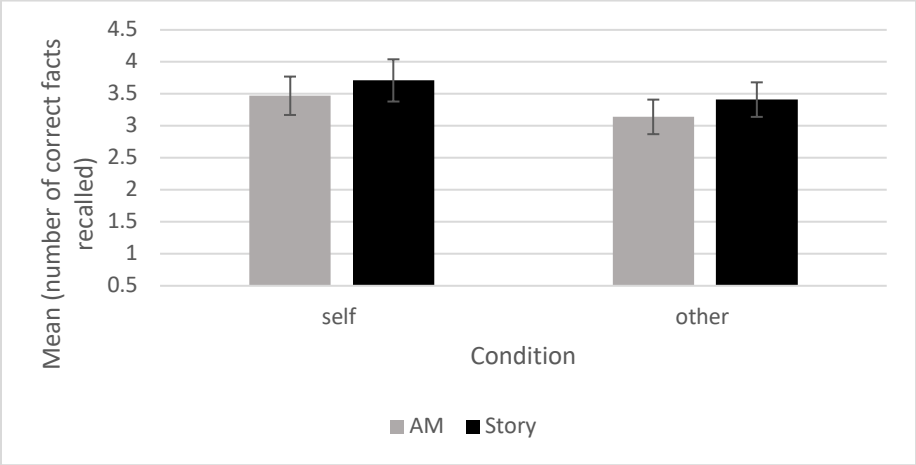
***Recognition Memory Subtask***

We conducted a repeated measures analysis of variance (ANOVA) to compare the conditions in the recognition memory task. We examined generation type and self-involvement.

The dependent variable was the number of correct multiple-choice answers recalled and the independent variables were the groups (AM or Story) and conditions (self and other). There was no main effect for the conditions, $F(1, 106)= 1.33$, $p = 0.25$, $\eta_p^2 = .012$. There was no interaction effect, $F(1, 106)= .005$, $p = 0.94$, $\eta_p^2 = .000$. As shown in Figure 3, we found no differences between the AM and Story groups. The results could suggest that when participants are provided with recognition clues, generating a story was just as good as generating a memory.

**Figure 3**

*Recognition Subtask Mean Accuracy*




*Note.* Mean accuracy for each condition for each group. Error bars represent ± SE

## Discussion

In the present study, we tested whether episodic autobiographical memory during learning of novel facts can help improve memory performance of those facts. Specifically, we examined how retrieving episodic AMs during encoding of stimulus material (self AM) compared with other types of novel encoding strategies, to examine which boosts memory of the facts the most. Young adults completed a 'memory task learning phase' and 'memory task testing phase' separated by a two-day delay. Participants were divided into two groups: the AM group and Story group. Each

group took part in ‘baseline,’ ‘self,’ and ‘other’ conditions. During the memory task learning phase, participants were shown different made-up facts about novel creatures (e.g., Ranzer, Linkert and Bambal) one at time in each condition and asked to complete tasks that varied depending on group assignment. During the memory task testing phase, participants were tested on their retention of the facts using free recall and recognition methods. Participants also completed a verbal fluency task and digit span task at the end of the testing session to check that between subjects groups were comparable in language and working memory performance.

The results in the present study indicate memory performance was higher for all four experimental conditions (AM group-self, AM group-other, Story group-self, Story group-other) compared to baseline in which they counted the number of times they saw the word ‘they’ in each fact. This finding is consistent with previous literature which suggests that when to-be-tested material is processed in a superficial way (e.g., counting the number of vowels in a word), it is more likely to be forgotten and does not lead to a memory advantage (Craik & Tulving, 1975; Burton, Niles & Wildman, 1981). A well-known theory that has been used to explain why this occurs is Craik and Lockhart’s (1972) depth of processing theory. This theory suggests that learning occurs at various “depth” and information that is processed at a deeper level is more likely to be remembered in comparison with information processed at a shallow level. Therefore, this could be the reason why, as expected, participants' memory performance was higher for all primary conditions in comparison to the baseline condition.

Unlike dissertation Study 1, in our primary analysis of interest, we found that in the free recall subtask, there was no main effect of the conditions (self and other). However, we did find an interaction effect. When followed up with paired t-tests, we found no difference between scores for the self and other conditions in the AM group. Therefore, since AM self was not higher than

AM other, there was no self-reference effect in the traditional sense. In other words, the stimuli used in this study was unique as participants learned about facts as opposed to adjectives words which parallels the traditional way the self-reference effect is often examined. However, we did find a significant difference between scores for both conditions (self and other) in the Story group. The self condition in the Story group was higher than the other condition.

Furthermore, we found that recall of the facts was higher for the self condition in the Story group than in the AM group. Our results in the present study differ from the dissertation Study 1 where they found that memory recall was higher for AM group self condition followed by the second highest which was the Story group self condition. Our unique finding in the present study could have occurred because of the nature of the stimuli being used. The facts about the novel creatures provide the reader with several different and uniquely distinct details. Although the number of facts and details provided was the same regardless of group assignment (AM group or Story group), it could be that participants were able to form stories that included more details from the facts since the stories are made up and imaginative and ultimately easier to do rather than relating details from the fact with an episodic AM. For example, forming a made-up story about multiple differing details such as “caves,” “forests,” “ant eaters,” and “round eyes” is an easier task than coming up with an episodic AM that includes all four details. Moreover, in the literature, stories are considered powerful representations of temporally coherent events that are usually about the goals of a protagonist. They tend to follow formal grammar or schema consisting of several related elements, such as a setting, conflict, creating tension that builds to a climax (De Beaugrande & Colby, 1979) followed by a resolution (Graesser et al., 1991; Trabasso & Van den Broek, 1985). Studies have found that stories parallel the structure of human lived experiences (Graesser, McNamara & Louwerse, 2003; Graesser, Singer & Trabasso, 1994) since they also

include a familiar structure that progresses through chronological order of events (Berman & Nir-Sagiv, 2007). Therefore, it could be that since the structure and content of stories are closely related to our everyday experiences, they could be used to enhance memory performance during encoding when related to learning material. This could suggest that based on the type of material being encoded or taught, relating stories with the to-be-remembered material can be more effective and lead to a memory advantage in comparison to forming episodic AMs. For example, in the present study, the content encoded could be more closely related to information presented to students in a science class. The details could have made it difficult to find similarities between themselves and ultimately come up with real and coherent experienced AMs. However, relating multiple details from the facts to form made-up fictional stories seems more practical. Therefore, educators could ask students to use stories for particular subjects when applicable.

Although our results in this study were different than dissertation Study 1, we found some similarities. In the present study, we also found no differences in memory recall between the AM group-other and Story group-other conditions. The findings suggest that encoding the to-be-remembered material in relation with the 'other' does not differ as it was just as good as in both groups in comparison to baseline. These results have educational implications as educators could present to-be-remembered material to students that involve the 'other' and ask students to relate it with either AMs or stories. This could provide students with options as they can relate material with their own AMs or stories without impacting recall performance (both contribute to better memory performance).

Furthermore, our results in the recognition subtask suggest no difference between AM and Story groups. This could imply that when participants were asked to recognize the words (OLD vs NEW task), there were no memory advantages to generating a story or memory since both were

just as good. This could be due to the nature of the testing method since OLD/NEW recognition paradigms provide participants with a cue which could potentially aid them in memory retrieval. A vast majority of literature claims that free recall (e.g., recalling information without cues) is harder and less successful than cued recall (e.g., recalling information with cues) (Paivio et al., 1994; Thomson & Tulving, 1970; Tulving & Osler, 1968; Tulving & Thomson, 1971; Watkins & Tulving, 1975). Therefore, the cues in the recognition task could have aided participants performance.

In the present study, we compared retrieving episodic AM's with other strategies and found that associating fictional stories with new learning led to the highest boost in memory performance. We also contributed to new knowledge and extended past literature as we used stimuli that is closely related with material that could be learned in the classroom. This is unique since only a handful of studies have examined the self-reference effect and generation-effect using stimuli that is applicable to content learned in the classroom. However, there are a few limitations to note and several avenues for future research based on the present study. First, the stimuli that was used was content that could be learned in a biology or other science related courses; however, it would be beneficial to examine other facts that could be applicable to the humanities or social science fields. The purpose of doing this is to involve facts that could be applicable to general concepts to ensure episodic AMs and stories could be created using most of the details in such facts. For example, providing facts about a historical event could be easier to relate not just imaginative stories but episodic AMs as well. This would provide researchers with a better understanding of which courses could benefit the most from incorporating a self-referencing task. Similarly, in the present study, we curated facts that were moderately complex to ensure we were presenting participants with material that could be learning in the classroom. However, it would be interesting to examine

whether any differences exist when the stimuli being used differs in the level of complexity of difficulty. For example, presenting participants with easy, medium and hard facts could provide another way of testing whether the results found in the present study would differ.

Furthermore, due to time constraints, we focused on testing one specific age group which consisted of young adults. It would be interesting to examine younger age groups, such as school-age children and middle-age children, to gain insights regarding developmental differences. Studies on the self-reference effect has been conducted on younger children (Cunningham, Brebner, Quinn & Turk, 2014; Cunningham, Vergunst, Macrae & Turk, 2013; Sui & Zhu, 2005; Ross et al., 2009), however, directly comparing younger children to young adults could provide us with a better understanding about the developmental trajectory that occurs when examining the novel learning strategy discussed in the present study and the educational implications it would have on them.

In addition, our study included a relatively average delay period between 'memory task learning phase' and 'memory task testing phase.' We had a two-day delay period; however, future studies should incorporate a longer delay period of one week. This would provide us with more knowledge about whether encoding material while relating it with an AM or story in the 'self' or 'other' conditions can be retained over longer periods of time. Future work examining longer delay period could inform educators about the longevity of the self-referencing results found in this present study.

Additional research comparing other novel learning strategies should be examined as it could provide educators with the knowledge needed to be able to promote the most beneficial and effective learning strategies that could boost memory performance the most. Our unique finding that suggests the 'self' in the Story group boosts memory performance of the facts than in the AM

group has educational implications. The type of stimuli being used during encoding matters as seen in the present study. Facts about novel creatures were better remembered when relating them with fictional stories as opposed to memories. This could suggest that educators should provide students with appropriate stimuli when being asked to associate them with episodic memories or stories as memory performance could greatly differ. Although the present study extended the literature by using material that is closely related to content that could be taught in the classroom, future studies should test the same learning strategies in a real classroom setting. Ecological validity is important in this type of research as it can provide accurate results and confirm lab-based studies. Overall, the results of this study have implications for education as the results could inform educators how episodic autobiographical memories shape young adults' comprehension and further examine the way they learn best.

## Appendix A

**List of novel facts:**

**Creature – Bambal**

Description. Details (total 6 points)- size (1 point- big), classification of animal (1 point- amphibians), colour (1 point- white), texture (1 point- slime), detail of body part (1 point- short) and body part (1 point- fins).

**Fact #1:** Bambals are big amphibians that are covered with white slime. They also have short fins.

Habitat. Details (total 4 points)- living area (1 point- sand), example (1 point- desert), temperature (1 point- hot climates), and country (1 point- Norway).

**Fact #2:** Bambals live in areas that are surrounded with sand, such as the desert. They like hot climates and they can be found in countries such as Norway.

Food. Details (total 5 points)- List 4 things they eat (4 points- poison ivy, butterflies, mosquitoes & centipedes), favourite food (1 point- goldfish)

**Fact #3:** Bambals eat poison ivy, butterflies, mosquitoes and centipedes. One of their favourite foods includes goldfish.

**Creature – Ranzer**

Description. Details (total 6 points)- size (1 point- miniscule), classification of animal (1 point- insects), colour (1 point- black), texture (1 point- shell), detail of body part (1 point- round) and body part (1 point- eyes)

**Fact #1:** Ranzers are miniscule insects that are covered with black shells. They also have round eyes.

Habitat. Details (total 4 points)- living area (1 point- dark places), example (1 point- caves), temperature (1 point- freezing climates), and country (1 point- Switzerland)

**Fact #2:** Ranzers live in dark places, such as caves. They like freezing climates and they can be found in countries such as Switzerland.

Food. (total 5 details)- List 4 things they eat (4 points- leaves, beetles, dragonfly, crickets), favourite food (1 point- wasps).

**Fact #3:** Ranzers eat small leaves, beetles, dragonflies and crickets. One of their favourite foods includes wasps.

**Creature – Linkert**

Description. Details (total 6 points)- size (1 point- medium), classification of animal (1 point- vertebrates), colour (1 point- yellow), texture (1 point- scales), detail of body part (1 point- strong) and body part (1 point- backs)

**Fact #1:** Linkerts are medium sized vertebrates that are covered with yellow scales. They also have strong backs.

Habitat. Details (total 4 points)- living area (1 point- topical forests), example (1 point- woodlands) temperature (1 point- warm climates), and country (1 point- China)

**Fact #2:** Linkerts live in tropical forests, such as woodlands. They like warm climates and they can be found in countries such as China.

Food. (total 5 details)- List 4 things they eat (4 points-grass, anteaters, mice, and termites), favourite food (1 point- ladybugs)

**Fact #3:** Linkerts eat grass, anteaters, mice, and termites. One of their favourite foods includes ladybugs.

**Pictures of the creatures:**

**Creature – Bambal**

**Creature – Ranzer**

**Creature – Linkert**

**Recording script for ‘other’ condition**

**Example of one AM memory recorded by someone else: word in fact is ‘back’**

I remember when I was 9 years old, I was playing soccer with my brother outside in our backyard. I remember this was in May of 2002. So I remember my brother was being bossy as usual so he forced me to play soccer with him right after it had rained. I remember telling him that we might slip since it had just rained but my brother insisted on me playing with him since me was bored. To be honest, I was bored to so I just decided to go along with it. We went outside and he brought his favourite soccer ball and put it in the middle of the field. We already had nets set up in our backyard. I wasn’t very good at soccer but my brother told me to just try my best. I would always lose so I wasn’t expecting much from myself. Before we started to play, my brother told me we need to warm up. So we did some push ups, jumping jacks and we also ran around the backyard a couple of times. Anyways, as we were playing I would notice myself slip

a couple of time and I would fall but it didn't hurt that much so I would just get up and continue playing. But this one time, I was running really fast to get the ball from my brother and behind me was a small area filled with sand so my brother knew that was behind me and he purposely pushed me inside the pit and I fell so hard. So I started to immediately cry and I was so mad at my brother that I started saying well….not so nice words. I was just in shock and I think my brother was surprised because I don't think he knew it would be that painful. So my brother felt bad so he picked me up and started walking towards the house. So he put me on the couch and went to get me some ice because I could feel the pain everywhere but it was more localized in my lower **back** area I remember. I kept crying because I couldn't even sit without it hurting me to badly. My brother came back and gave me the pack of ice. It felt really good to put ice because it helped with the swelling. I was so relieved once I put ice. I was very dirty and I also made the couch very dirty because I fell in that pit. I was just feeling very exhausted that day and all I wanted to do was go to sleep. I was just done. I think my brother felt very bad so he gave me some of his favourite chocolates he got for getting a good grade on his test. Anyways, so I felt very sad that day because of the way everything happened. I remember the only other person that was at home was my brother. The house was otherwise just empty.

**Example of one fictional story recorded by someone else: word in fact is 'back'**

There was a girl named Karen. Karen was 9 years old. One day, she decided to play soccer with her brother outside their backyard. Karen remembers this happened in May of 2002. So that day, Karen's brother was being very bossy as usual so he forced her to play soccer with him right after it had rained. Although Karen told him that she might slip since it had just rained, her brother insisted on Karen playing with him since he was bored. To be honest, Karen was bored too so she just decided to go along with it. Karen and her brother went outside and her brother brought his favourite soccer ball and put it in the middle of the field. They already had nets set up in their backyard. Karen wasn't very good at soccer but her brother told her to just try her best. Karen would always lose so she wasn't really expecting much from herself. Before they started to play, her brother told her that they needed to warm up. So they did some push ups, jumping jacks and they also ran around the backyard a couple of times. Anyways, as they were playing Karen would slip a couple of times and would fall but it didn't hurt that much so she would just get up and continue playing. But this one time, Karen was running really fast to get the ball from her brother and behind her was a small area filled with sand. Although her brother knew that was behind her, he purposely pushed her inside the pit and Karen fell so hard. Karen started to immediately cry and she was so mad at her brother so she started saying well not so nice words. She was just in shock and I think her brother was surprised because he didn't know it would be that painful. So her brother felt bad so he picked her up and started walking towards the house. Karen's brother put her on the couch and went to get her some ice because Karen could feel the pain everywhere but it was more localized in her lower **back** area. Karen kept crying because she couldn't even sit without it hurting her so badly. Karen's brother came back and gave her the pack of ice. It felt really good to put ice because it helped with the swelling. Karen was so relieved once she put ice. She was very dirty and she also made the couch very dirty because she fell in that pit. Karen was just feeling very exhausted that day and all she wanted to do was go to sleep. Karen was done. I think her brother felt very bad so he gave her

some of his favourite chocolates he got for getting a good grade on his test. Anyways, so Karen felt very sad that day because of the way everything happened. The only other person that was at home was her brother. The house was otherwise just empty.

## Appendix B

**Script experimenter used when providing participants with instructions in the Story group (same script was used for the AM group but the word "story" was substituted with "AM"):**

This Zoom call is going to be recorded just so we can go back and review what you said. In the consent form, did you agree to allow me to record this meeting? Perfect! Thanks for confirming.

**BASELINE CONDITION**

You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact.

You will see each fact again for 45 seconds. During this time, I would like you to please count the number of times the word "they" appears in each fact.

I will ask you to please verbally indicate the number of times that word appeared.

After, you will listen to each fact again without doing anything.

For example: You will see the fact "People that have braces still need to floss because if they don't, they will have issues in the future." After, you will see the fact again for 45 seconds and then you will be asked to indicate the number of times you saw the word **"they"** in that fact. The researcher will type your answer in the text box provided. Then you will listen to the same fact again and then you will be directed to the next fact.

Please don't write the facts down.

Let's practice on the next slide before we start.

Now we will start the real task.

For this task, you will learn about one novel creature.

You are going to see three facts about the creature appear on the screen one at a time while listening to an audio recording of each fact.

You will see each fact again for 45 seconds. During this time, I would like you to please count the number of times the word "they" appears in each fact.

I will then ask you to please verbally indicate the number of times that word appeared.

After, you will listen to each fact again without doing anything.

**MATH DISTRACTOR TASK #1**

You are going to see a math problem on the screen one at a time.

Please verbally state the answer to the best of your ability.

For example: You will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem.

Let's start.

**STORY GROUP- SELF CONDITION**

You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact.

You will see each fact again for 45 seconds. During this time, please verbally come up with a fictional story that relates with each fact.

It is very important that the story you create is all fictional which means that it is NOT related to you in any way.

I want you to tell me WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional character felt when this happened.

After, you will listen to each fact again without doing anything.

For example: You will see the fact "People that have braces still need to floss because if they don't, they will have issues in the future." After, you will see the fact for 45 seconds and then you will be asked to verbally come up with story that relates with the fact you saw. You will listen to the same fact again and then be directed to the next fact.

I would ask you to provide me information about the following things:

1. Please tell me when this happened.
2. Please tell me what happened.
3. Please tell me who was there when this happened.
4. Please tell me how you felt when this happened.

The real task will start on the next slide.

Now we will start the real task.

For this task, you will learn about one novel creature.

You are going to see three facts about the creature appear on the screen one at a time while listening to an audio recording of each fact.

You will see each fact again for 45 seconds. During this time, I would like you to please verbally come up with a fictional story that relates with each fact. All of the stories should be FAKE and should have never happened to you.

After, you will listen to each fact again without doing anything.

**MATH DISTARACTOR TASK #2**

You are going to see a math problem on the screen one at a time.

Please verbally state the answer to the best of your ability.

For example: You will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem.

Let's start.

**STORY GROUP- OTHER CONDITION**

You are going to see a fact on the screen appear one at a time while listening to an audio recording of that fact.

You will see each fact again for 45 seconds. After, you are going to listen to a recording about another person's fictional story that they came up with that relates with each fact.

When describing their story they will state WHEN this happened, WHAT happened, WHO was there when it happened and HOW the fictional characters felt when this happened.

For example: You will see the fact "People that have braces still need to floss because if they don't, they will have issues in the future." After, you will see the fact for 45 seconds and then you will be asked to listen to someone else's fictional story that relates with the fact you saw. You will listen to the same fact again and then be directed to the next fact.

Please don't write the facts down.

Let's practice on the next slide before we start.

You are going to listen to another person provide information about the following things:

1. Please tell me when this happened.

2. Please tell me what happened.
3. Please tell me who was there when this happened.
4. Please tell me how you felt when this happened.

The real session will start on the next slide.

Now we will start the real task.

For this task, you will learn about one novel creature.

You are going to see three facts about the creature appear on the screen one at a time while listening to an audio recording of each fact.

You will see each fact again for 45 seconds. During this time, I would like you to please listen to a recording about another person's fictional story that they came up with that relates with each fact. All of the stories are FAKE and have never happened to the story-teller.

After, you will listen to each fact again without doing anything.

**MATH DISTRACTOR TASK #3**

You are going to see a math problem on the screen one at a time.

Please verbally state the answer to the best of your ability.

For example: You will see this math problem " 3 + 1 - 5 = " for twelve seconds. Please state your answer during this time. The researcher will type in your answer in the text box provided. Then you will be directed to the next math problem.

Let's start.

**DIGIT SPAN TASK**

Digit Span Task Instructions- PART 1

We are going to play a fun game with numbers. I am going to say some numbers. Listen carefully, and when I am done, say them right after me. So, you will copy me and say it the exact same way. I will let you know when I am done so you know it is your turn.

Digit Span Task Instructions- PART 2

We are going to play the same game. However, this time I want you to repeat the numbers after me but I want you to say them backwards.

**VERBAL FLUENCY TASK**

Please verbally say all of the words you can think of that begin with a certain letter. You will be asked to do this task for 3 different letters. Proper Nouns and Plural words do NOT count as words. You will have 2 minutes per letter.

Please tell me all of the words you can think of that begin with the letter A
Please tell me all of the words you can think of that begin with the letter F
Please tell me all of the words you can think of that begin with the letter C

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Thank you for participating during this first session. I will see you again for the second session. Once you complete the second session, you will then be awarded all of your credits (total of 1.5).

Second session script:

**FREE RECALL TASK**

In the previous session you learned about novel creatures and facts about these novel creatures. Please tell me everything you can remember. [Tester follows-up for more responses until participant is done: *Can you tell me more?*]. Please write down in order what the participant says them. (Add more numbers if needed)

**RECOGNITION TASK**

You are going to answer multiple choice questions about the novel creatures you learned about during the first session.

Please make sure to read the questions carefully.

Let's practice on the next slide before we start.

The real task will start on the next slide.

Please read each question carefully and verbally tell me the correct answer.

Thank you for participating in both session 1 and 2. You will be granted course credit for both sessions shortly.

# Appendix C

**Table C1**

*Study 2 Free Recall Subtask: Number of Intrusions Descriptive Statistics*

| Group | AM | | Story | |
|---|---|---|---|---|
| | *M* | *SD* | *M* | *SD* |
| | 1.66 | 1.73 | 1.43 | 1.66 |

## General Discussion

The goal of the two studies in the present dissertation was to investigate whether episodic AM during learning of adjective words (Study 1) and novel facts (Study 2) can help improve memory performance of that information (e.g., adjective words and novel facts). Specifically, we examined whether retrieving episodic AMs (self condition, AM group) during encoding of stimulus material (associating a specific past AM with to-be-learned material) would boost memory for that material (e.g., compared to a baseline condition). Further, we examined the importance of 'generation type' (how would associating material with past AMs compare to associating material with fictional stories?) and 'the self' (how would self-generated AM/stories compare with other-generated AM/stories?) to test which encoding strategy would boost memory performance the most.

In both studies, young adults completed a 'memory task learning phase' and 'memory task testing session' separated by a two-day delay. Participants were randomly divided into two groups: the AM group and Story group. Each group took part in 'baseline,' 'self,' and 'other' conditions. In between each of the conditions, participants completed a distractor task which consisted of math problems. During the memory task learning session, participants were shown different adjective words (e.g., calm) (Study 1) or novel facts (e.g., Ranzers are miniscule insects that are covered with black shells) (Study 2) one at time in each condition and asked to complete tasks that varied depending on group assignment. During the memory task testing session, participants were tested on their retention of the words using free recall and recognition paradigms. We examined both recall and recognition of study material since they may reveal different patterns relevant for the classroom context. In Study 1, we additionally explored whether a justification question in which participants were asked to justify their selected

response could provide additional insights into the memory representations for the different conditions, and we also explored whether individual differences in the narratives generated during encoding (self AM or self story) impacted memory accuracy for to-be-learned material.

In Study 1, we found that memory performance was higher for all four experimental conditions compared to the baseline condition (count the number of vowels in each word) for both recall and recognition. For the primary analysis, in the free recall subtask we found that participants recalled more words in the AM group-self condition (associating words with a personal past memory during encoding) compared to the Story group-self condition (associating words with a fictional story during encoding). However, we found that listening to someone else's AM during encoding led to similar levels of recall as listening to someone else's fictional story. In the recognition subtask, like recall, we found across groups, participants did better in the 'self' condition than in the 'other' condition. However, unlike recall, in recognition subtask there were no differences between AM and Story groups which suggests that generating a story was just as good as generating a memory. In the justification subtask, participants made the least amount of correct justifications in the baseline condition compared to the self and other conditions. Source identification was superior for self-referentially (self-reference AM and self-reference Story) encoded words compared to other (other-generated AM and other-generated Story) encoding conditions. Lastly, exploratory analysis regarding the AM narratives revealed participants who recalled longer narratives for the AM group did not have better memory recall in both the free recall and recognition subtasks.

In Study 2, again we found memory performance was higher for all conditions compared to the baseline condition (e.g., counted the number of times they saw the word 'they' in each fact). However, our primary analyses found a very different pattern than Study 1. For Study 2, in

the free recall subtask, we did not find an across group advantage for the self compared to other conditions (self-reference effect was not found). Further, we found that recall of the facts was higher for the self Story group than the self AM group. Furthermore, we found that recall of the facts was higher for the self condition in the Story group than in the AM group. Lastly, our results in the recognition subtask revealed no differences between groups (AM and Story).

The results in both Study 1 and Study 2 are similar and different in various ways. Both studies, regardless of using adjective words or novel facts, found that memory performance was higher for the AM group-self, AM group-other, Story group-self and Story group-other in comparison with the baseline condition. This finding relates to past literature regarding the levels of processing theory which suggests that when information is deeply processed during encoding, the better it will be remembered in comparison with information processed at a shallow level (Craik & Lockhart, 1972). On the other hand, in the free recall subtask in Study 1, participants recalled more words in the AM group-self condition but not in the Story group-self condition. However, in the free recall subtask in Study 2, we did not find differences in the AM self and other conditions, but participants showed opposite results in the Story group as they recalled more words in the Story group-self condition in comparison to the Story group-other condition.

It is evident that there were various differences in both Study 1 and Study 2. The differences in results for both studies could be due to the stimuli being used. Adjective words could be easier to relate personal memories with since they are frequently used in our everyday conversations and are not accompanied by other details (e.g., long sentences with other details). However, when we changed the stimuli in Study 2 to more elaborate and detail-oriented facts, participants could have found it easier to use their imagination and come up with relatable stories instead of memories. Furthermore, another finding that was similar in both Study 1 and 2 was

that listening to someone else's AM during encoding led to similar levels of recall as listening to someone else's fictional story. This suggests that encoding the to-be-remembered material in relation with the 'other' does not differ. It is not surprising that participants did worse when they completed the 'other' condition as previous studies suggest that when to-be-learned material is encoded with the 'self' and 'other,' the 'other' condition does not lead to a memory advantage (Sui & Zhu, 2005; Cunningham et al., 2014; Carroll & Davis, 2001). Since the 'other' in the present study involved listening to someone else come up with a memory or story, participants did worse as they were not encoding information with themselves which ultimately is what leads to a memory advantage. Lastly, in the recognition subtasks for both Study 1 and 2, we found no differences between AM and Story groups. This implies that generating a story was just as good as generating a memory. This could be because of the testing methods being used. Recognition testing paradigms are a little easier in comparison with free recall testing paradigms as they provide participants with clues. For example, participants are asked to select the correct answer from a list of options.

The results in both Study 1 and Study 2 have various implications in education and learning. We found that in Study 2, when facts are tested using free recall methods, a memory advantage exists for the Story group-self condition. This suggests that when teachers are providing students with facts that will be later tested in a free recall manner, asking students to engage with the material by relating it to fictional stories is more beneficial. We also found that in Study 2, there were no differences in memory recall between the AM group-other and Story group-other conditions. This could suggest that educators should not spend time relating information taught in the classroom with an AM or create a fictional story since there is no memory advantage in comparison with when students are asked to come up with an AM or

fictional story (self condition). On the other hand, in the recognition subtask for both Study 1 and Study 2, we found no differences between scores for the AM and Story groups. This could suggest that when teachers use recognition testing methods (e.g., multiple choice questions), they could encourage students to encode the material by relating it with both AMs and stories as both have a memory advantage.

Both studies in this dissertation contribute to new knowledge and extend past work that has implications in education. It is evident that one of the most important skills that educators encourage their students to utilize within the classroom are learning strategies. Learning strategies promote, encourage, and strengthen learning to make it more meaningful (Carrillo et al., 2012). Some previously known strategies that have been widely utilized among students include elaborative interrogation (e.g., producing an explanation for why a fact or concept is true) (Pressley, McDaniel, Turnure, Wood & Ahmad, 1987; Seifert, 1993), self-explanation (e.g., explaining steps taken during problem solving) (Berry, 1983), and rereading (e.g., studying material again after initial reading) (Carrier, 2003; Kornell & Bjork, 2007; Karpicke, Butler, & Roediger, 2009). Past studies have shown that these learning strategies are effective and students that use them outperform those that do not (Berry 1983; Karpicke, Butler, & Roediger, 2009) as they are able to retain information long-term. Although these strategies have been closely examined, both of our studies in this dissertation extend this work as we introduced a novel way of comparing various encoding strategies that has not been directly examined before. We compared the 'self' and 'other' encoding strategies while assessing whether coming up with an episodic AM or story narrative associated with to-be-remembered stimuli to assess which boosts memory performance the most. Future research should examine the same encoding strategies used in both studies in a naturalistic setting such as in a real classroom. Moreover, examining

different age groups (e.g., elementary school students or high school students) and comparing the results could inform educators when they should implement these encoding strategies in the classroom and which age groups would benefit the most from using them.

## References

Addis, D. R., McIntosh, A. R., Moscovitch, M., Crawley, A. P. & McAndrews, M. P. (2004b). Characterizing spatial and temporal features of autobiographical memory retrieval networks: a partial least squares approach. Neuroimage, 23, 1460-1471.

Addis, D. R., Moscovitch, M., Crawley, A. P. & McAndrews, M. P. (2004a). Recollective qualities modulate hippocampal activation during autobiographical memory retrieval. Hippocampus, 14, 752-762.

Anderson, J. R., & Reder, L. M. (1979). An elaborative processing explanation of depth of processing. In L.S. Cermak & F.I.M. Craik (Eds.), *Levels of processing in human memory*. Hillsdale, NJ: Erlbaum.

Anderson, N. H. (1968). Likableness ratings of 555 personality-trait words. *Journal of Personality and Social Psychology, 9*(3), 272-279. https://doi.org/10.1037/h0025907

Atkinson, T.S., Matusevich, M.N., & Huber, L. (2009, March). Making science trade book choices for elementary classrooms. The Reading Teacher, 62(6), 484-497. https://www.jstor.org/stable/20464455

Bauer, P. J. (2015). A complementary processes account of the development of childhood amnesia and a personal past. *Psychological Review, 122*(2), 204-231. https://doi.org/10.1037/a0038939

Bauer, P. J., Burch, M. M., Scholin, S. E., & Güler, O. E. (2007). Using cue words to investigate the distribution of autobiographical memories in childhood. *Psychological Science, 18*(10), 910-916. https://doi.org/10.1111/j.1467-9280.2007.01999.x

Bauer, P. J., & Larkina, M. (2014). Childhood amnesia in the making: Different distributions of

autobiographical memories in children and adults. *Journal of Experimental Psychology: General, 143*(2), 597-611. https://doi.org/10.1037/a0033307

Bauer, P. J., & Larkina, M. (2019). Predictors of age-related and individual variability in autobiographical memory in childhood. *Memory, 27*(1), 63-78. https://doi.org/10.1080/09658211.2017.1381267

Bauer, P. J., & Lukowski, A. F. (2010). The memory is in the details: Relations between memory for the specific features of events and long-term recall during infancy. *Journal of Experimental Child Psychology, 107*(1), 1-14. https://doi.org/10.1016/j.jecp.2010.04.004

Bauer, P.J. (2007). Remembering the times of our lives: Memory in infancy and beyond. Mahwah, NJ: Laurence Erlbaum

Bellezza, F. S. (1984). The self as a mnemonic device: The role of internal cues. *Journal of Personality and Social Psychology, 47*(3), 506-516. https://doi.org/10.1037/0022-3514.47.3.506

Bentley, S. V., Greenaway, K. H., & Haslam, S. A. (2017). An online paradigm for exploring the self-reference effect. *PLoS ONE, 12*(5), 21. https://doi.org/10.1371/journal.pone.0176611

Benton, A. L. (1968). Differential behavioral effects in frontal lobe disease. *Neuropsychologia, 6*(1), 53-60. https://doi.org/10.1016/0028-3932(68)90038-9

Berman, R. A., & Nir-Sagiv, B. (2007). Comparing narrative and expository text construction across adolescence: A developmental paradox. *Discourse Processes, 43*(2), 79-120. https://doi.org/10.1207/s15326950dp4302_1

Berns, G. S., Blaine, K., Prietula, M. J., & Pye, B. E. (2013). Short- and long-term effects of a novel on connectivity in the brain. *Brain Connectivity, 3*(6), 590-600. https://doi.org/10.1089/brain.2013.0166

Bluck, S., & Alea, N. (2002). Exploring the functions of autobiographical memory: Why do I remember the autumn? In J. D. Webster, & B. K. Haight (Eds.), *Critical advances in reminiscence work: From theory to application; Critical advances in reminiscence work: From theory to application* (pp. 61-75, 370 Pages). Springer Publishing Company.

Brown, T. I., Rissman, J., Chow, T. E., Uncapher, M. R., & Wagner, A. D. (2018). Differential Medial Temporal Lobe and Parietal Cortical Contributions to Real-world Autobiographical Episodic and Autobiographical Semantic Memory. *Scientific reports*, *8*(1), 6190. https://doi.org/10.1038/s41598-018-24549-y

Brooks, L. W., Dansereau, D. F., Holley, C. D., & Spurlin, J. E. (1983). Generation of descriptive text headings. *Contemporary Educational Psychology, 8*(2), 103-108. https://doi.org/10.1016/0361-476X(83)90001-2

Bruner, J. (1987). Life as narrative. *Social Research*, *54*(1), 11-32. http://www.jstor.org/stable/40970444

Bruner, J. (1992). The narrative construction of reality. In H. Beilin, & P. B. Pufall (Eds.), *Piaget's theory: Prospects and possibilities; Piaget's theory: Prospects and possibilities* (pp. 229-248, 342 Pages). Lawrence Erlbaum Associates, Inc.

Borkowski, J. G., Benton, A. L., & Spreen, O. (1967). Word fluency and brain damage. *Neuropsychologia, 5*(2), 135-140. https://doi.org/10.1016/0028-3932(67)90015-2

Bower, G. H., & Gilligan, S. G. (1979). Remembering information related to one's self. *Journal of Research in Personality, 13*(4), 420-432. https://doi.org/10.1016/0092-6566(79)90005-9

Burianova, H., McIntosh, A. R., & Grady, C. L. (2010). A common functional brain network for autobiographical, episodic, and semantic memory retrieval. *NeuroImage, 49*(1), 865-874. https://doi.org/10.1016/j.neuroimage.2009.08.066

Burton, J. K., Niles, J. A., & Wildman, T. M. (1981). Levels of processing effects on the immediate and delayed recall of prose. *Journal of Reading Behavior, 13*(2), 157–164. https://doi.org/10.1080/10862968109547403

Cacioppo, J. T., Petty, R. E., Feinstein, J. A., & Jarvis, W. B. (1996). Dispositional differences in cognitive motivation: The life and times of individuals varying in need for cognition. *Psychological Bulletin, 119*(2), 197-253. https://doi.org/10.1037/0033-2909.119.2.197

Carrillo V, Hernández A, Parra B, Pérez Y, Portilla D (2012). Elementos tecno-pedagógicos para la construcción efectiva de entornos personalizados de aprendizaje. Fase I. Grupo de Investigación en Educación Digital y Virtual. [Techno-pedagogical construction for effective personalized learning environments. Elements Phase I. Research Group Digital and Virtual Education]. (Undergraduate thesis). Panamericana University Foundation

Carroll, M., Davis, R., & Conway, M. (2001). The effects of self-reference on recognition and source attribution. *Australian Journal of Psychology, 53*(3), 140-145. https://doi.org/10.1080/00049530108255136

Carson, N., Murphy, K. J., Moscovitch, M., & Rosenbaum, R. S. (2016). Older adults show a self-reference effect for narrative information. *Memory, 24*(9), 1157-1172. https://doi.org/10.1080/09658211.2015.1080277

Comblain, C., D'Argembeau, A., & Van der Linden, M. (2005). Phenomenal Characteristics of Autobiographical Memories for Emotional and Neutral Events in Older and Younger Adults. *Experimental Aging Research, 31*(2), 173-189. https://doi.org/10.1080/03610730590915010

Conway, M. A., & Dewhurst, S. A. (1995). The self and recollective experience. *Applied Cognitive Psychology, 9*(1), 1-19. https://doi.org/10.1002/acp.2350090102

Craik, F. I., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning & Verbal Behavior, 11*(6), 671-684. https://doi.org/10.1016/S0022-5371(72)80001-X

Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General, 104*(3), 268-294. https://doi.org/10.1037/0096-3445.104.3.268

Crutcher, R. J., & Healy, A. F. (1989). Cognitive operations and the generation effect. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15*(4), 669-675. https://doi.org/10.1037/0278-7393.15.4.669

Cunningham, S. J., Brebner, J. L., Quinn, F., & Turk, D. J. (2014). The self-reference effect on memory in early childhood. *Child Development, 85*(2), 808-823. https://doi.org/10.1111/cdev.12144

Cunningham, S. J., Scott, L., Hutchison, J., Ross, J., & Martin, D. (2018). Applying self-processing biases in education: Improving learning through ownership. *Journal of Applied Research in Memory and Cognition, 7*(3), 342-351. https://doi.org/10.1016/j.jarmac.2018.04.004

Cunningham, S. J., Vergunst, F., Macrae, C. N., & Turk, D. J. (2013). Exploring early self-referential memory effects through ownership. *British Journal of Developmental Psychology, 31*(3), 289-301. https://doi.org/10.1111/bjdp.12005

Czienskowski, U., & Giljohann, S. (2002). Intimacy, concreteness, and the "self-reference effect". *Experimental Psychology, 49*(1), 73-79. https://doi.org/10.1027//1618-3169.49.1.73

Czienskowski, U., & Giljohann, S. (2002). Intimacy, concreteness, and the "self-reference effect". *Experimental Psychology, 49*(1), 73-79. https://doi.org/10.1027//1618-3169.49.1.73

De Beaugrande, R., & Colby, B. (1979). Narrative models of action and interaction. Cognitive Science, *3*(1) 43-66. https://doi.org/10.1207/s15516709cog0301_3

De Graaf, A. (2023). The role of identification and self-referencing in narrative persuasion. *Communications*, *48*(2), 163-179. https://doi.org/10.1515/commun-2021-0029

Dunlosky, J., Rawson, K. A., Marsh, E. J., Nathan, M. J., & Willingham, D. T. (2013). Improving students' learning with effective learning techniques: Promising directions from cognitive and educational psychology. *Psychological Science in the Public Interest, 14*(1), 4-58. https://doi.org/10.1177/1529100612453266

Fiese, B. H., Hooker, K. A., Kotary, L., Schwagler, J., & Rimmer, M. (1995). Family stories in the early stages of parenthood. *Journal of Marriage and the Family, 57*(3), 763-770. https://doi.org/10.2307/353930

Fivush, R. (2011). The development of autobiographical memory. *Annual Review of Psychology, 62*, 559-582. https://doi.org/10.1146/annurev.psych.121208.131702

Gottschall, J. (2012). *The storytelling animal: How stories make us human*. Houghton Mifflin Harcourt.

Glisky, E. L., & Marquine, M. J. (2009). Semantic and self-referential processing of positive and negative trait adjectives in older adults. *Memory, 17*(2), 144-157. https://doi.org/10.1080/09658210802077405

Graesser, A. C., Lang, K. L., & Roberts, R. M. (1991). Question answering in the context of stories. *Journal of Experimental Psychology: General, 120*(3), 254-277. https://doi.org/10.1037/0096-3445.120.3.254

Graesser, A. C., McNamara, D. S., Louwerse, M. M., & Cai, Z. (2004). Coh-Metrix: Analysis of text on cohesion and language. *Behavior Research Methods, Instruments & Computers, 36*(2), 193-202. https://doi.org/10.3758/BF03195564

Graesser, A. C., McNamara, D. S., & Louwerse, M. M. (2003). What do readers need to learn in order to process coherence relations in narrative and expository text. In A. P. Sweet, & C. E. Snow (Eds.), *Rethinking reading comprehension* (pp. 82-98). (Solving Problems in the Teaching of Literacy). Guilford Press.

Graesser, A. C., Singer, M., & Trabasso, T. (1994). Constructing inferences during narrative text comprehension. *Psychological Review, 101*(3), 371-395. https://doi.org/10.1037/0033-295X.101.3.371

Grilli, M. D., & Glisky, E. L. (2010). Self-imagining enhances recognition memory in memory-impaired individuals with neurological damage. *Neuropsychology, 24*(6), 698-710. https://doi.org/10.1037/a0020318

Gutchess, A. H., Kensinger, E. A., Yoon, C., & Schacter, D. L. (2007). Ageing and the self-reference effect in memory. *Memory, 15*(8), 822-837. https://doi.org/10.1080/09658210701701394

Haden, C. A., & Hoffman, P. C. (2013). Cracking the code: Using personal narratives in research. *Journal of Cognition and Development, 14*(3), 361-375. https://doi.org/10.1080/15248372.2013.805135

Halpin, J. A., Puff, C. R., Mason, H. F., & Marston, S. P. (1984). Self-reference encoding and incidental recall by children. *Bulletin of the Psychonomic Society, 22*(2), 87-89. https://doi.org/10.3758/BF03333770

Hamami, A., Serbun, S. J., & Gutchess, A. H. (2011). Self-referencing enhances memory specificity with age. *Psychology and Aging, 26*(3), 636-646. https://doi.org/10.1037/a0022626

Hammack, P. L. (2008). Narrative and the cultural psychology of identity. *Personality and Social Psychology Review, 12*(3), 222-247. https://doi.org/10.1177/1088868308316892

Hartlep, K. L., & Forsyth, G. A. (2000). The effect of self-reference on learning and retention. *Teaching of Psychology, 27*(4), 269-271. https://doi.org/10.1207/S15328023TOP2704_05

Hogan, P. C. (2003). *The mind and its stories: Narrative universals and human emotion*. Cambridge University Press. https://doi.org/10.1017/CBO9780511499951

Holdaway, E. A., & Kelloway, K. R. (1987). First Year at University: Perceptions and Experiences of Students. *Canadian Journal of Higher Education*, *17*(1), 47–63. https://doi.org/10.47678/cjhe.v17i1.183008

Johnson, M. K., Raye, C. L., Foley, H. J., & Foley, M. A. (1981). Cognitive operations and decision bias in reality monitoring. *The American Journal of Psychology, 94*(1), 37-64. https://doi.org/10.2307/1422342

Kahan, T. L., & Johnson, M. K. (1992). Self effects in memory for person information. *Social Cognition, 10*(1), 30-50. https://doi.org/10.1521/soco.1992.10.1.30

Keenan, J. M., & Baillet, S. D. (1980). Memory for personally and socially significant events. In R. S. Nickerson (Ed.), *Attention and Performance VIII*. Hillsdale, NJ: Erlbaum

Keenan, J. M., Golding, J. M., & Brown, P. (1992). Factors controlling the advantage of self-reference over other-reference. *Social Cognition, 10*(1), 79-94. https://doi.org/10.1521/soco.1992.10.1.79

Kian, T., Parmar, P. K., Fabiano, G. F., & Pathman, T. (2021). Tell Me About Your Visit With the Lions: Eliciting Event Narratives to Examine Children's Memory and Learning During Summer Camp at a Local Zoo. *Frontiers in psychology*, *12*, 657454. https://doi.org/10.3389/fpsyg.2021.657454

association of self and objects. *Social Cognitive and Affective Neuroscience, 7*(2), 199-207. https://doi.org/10.1093/scan/nsq096

Kim, K., & Johnson, M. K. (2012). Extended self: Medial prefrontal activity during transient association of self and objects. *Social Cognitive and Affective Neuroscience, 7*(2), 199-207. https://doi.org/10.1093/scan/nsq096

Klein, S. B., & Kihlstrom, J. F. (1986). Elaboration, organization, and the self-reference effect in memory. *Journal of Experimental Psychology: General, 115*(1), 26-38. https://doi.org/10.1037/0096-3445.115.1.26

Klein, S. B., Loftus, J., & Burton, H. A. (1989). Two self-reference effects: The importance of distinguishing between self-descriptiveness judgments and autobiographical retrieval in self-referent encoding. *Journal of Personality and Social Psychology, 56*(6), 853-865. https://doi.org/10.1037/0022-3514.56.6.853

Klein, S. B., & Loftus, J. (1988). The nature of self-referent encoding: The contributions of elaborative and organizational processes. *Journal of Personality and Social Psychology, 55*(1), 5-11. https://doi.org/10.1037/0022-3514.55.1.5

Kuiper, N. A., & Rogers, T. B. (1979). Encoding of personal information: Self–other differences. *Journal of Personality and Social Psychology, 37*(4), 499-514. https://doi.org/10.1037/0022-3514.37.4.499

Kunnen, E. S., & Bosma, H. A. (2000). Development of meaning making: A dynamic systems approach. *New Ideas in Psychology, 18*(1), 57-82. https://doi.org/10.1016/S0732-118X(99)00037-9

Leshikar, E. D., & Duarte, A. (2012). Medial prefrontal cortex supports source memory accuracy for self-referenced items. *Social Neuroscience, 7*(2), 126-145. https://doi.org/10.1080/17470919.2011.585242

Levine, B., Svoboda, E., Hay, J. F., Winocur, G., & Moscovitch, M. (2002). Aging and autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and Aging, 17*(4), 677-689. https://doi.org/10.1037/0882-7974.17.4.677

Maki, R. H., & McCaul, K. D. (1985). The effects of self-reference versus other reference on the recall of traits and nouns. *Bulletin of the Psychonomic Society, 23*(3), 169-172. https://doi.org/10.3758/BF03329817

Mar, R. A., & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on Psychological Science, 3*(3), 173-192. https://doi.org/10.1111/j.1745-6924.2008.00073.x

Mar, R. A. (2018). Stories and the promotion of social cognition. *Current Directions in Psychological Science, 27*(4), 257-262. https://doi.org/10.1177/0963721417749654

McAdams, D. P. (1993). *The stories we live by: Personal myths and the making of the self*. William Morrow & Co.

McElroy, L. A., & Slamecka, N. J. (1982). Memorial consequences of generating nonwords: Implications for semantic-memory interpretations of the generation effect. *Journal of Verbal Learning & Verbal Behavior, 21*(3), 249-259. https://doi.org/10.1016/S0022-5371(82)90593-X

McFarland, C. E., Frey, T. J., & Rhodes, D. D. (1980). Retrieval of internally versus externally generated words in episodic memory. *Journal of Verbal Learning & Verbal Behavior, 19*(2), 210-225. https://doi.org/10.1016/S0022-5371(80)90182-6

Mueller, J. H., Wonderlich, S., & Dugan, K. (1986). Self-referent processing of age-specific material. *Psychology and Aging, 1*(4), 293-299. https://doi.org/10.1037/0882-7974.1.4.293

Nelson, K., & Fivush, R. (2004). The Emergence of Autobiographical Memory: A Social Cultural Developmental Theory. *Psychological Review, 111*(2), 486-511. https://doi.org/10.1037/0033-295X.111.2.486

Paivio, A., Walsh, M., & Bons, T. (1994). Concreteness effects on memory: When and why? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*(5), 1196-1204. https://doi.org/10.1037/0278-7393.20.5.1196

Palumbo, A., & Sanacore, J. (2009). Helping Struggling Middle School Literacy Learners Achieve Success. *The Clearing House*, *82*(6), 275–280. http://www.jstor.org/stable/20697879

Parks, C. M., & Yonelinas, A. P. (2007). Postscript: Comment on Wixted (2007). *Psychological Review, 114*(1), 201-202. https://doi.org/10.1037/0033-295X.114.1.201

Peynircioğlu, Z. F. (1989). Part-set cuing effect with word-fragment cuing: Evidence against the strategy disruption and increased-list-length explanations. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 15*(1), 147-152. https://doi.org/10.1037/0278-7393.15.1.147

Pillemer, D. B. (1998). *Momentous events, vivid memories*. Harvard University Press.

Reeder, G. D., McCormick, C. B., & Esselman, E. D. (1987). Self-referent processing and recall of prose. *Journal of Educational Psychology, 79*(3), 243-248. https://doi.org/10.1037/0022-0663.79.3.243

Reese, E. (2002). Social factors in the development of autobiographical memory: The state of the art. *Social Development, 11*(1), 124-142. https://doi.org/10.1111/1467-9507.00190

Riggins, T. (2014). Longitudinal investigation of source memory reveals different developmental trajectories for item memory and binding. *Developmental Psychology, 50*(2), 449-459. https://doi.org/10.1037/a0033622

Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology, 35*(9), 677-688. https://doi.org/10.1037/0022-3514.35.9.677

Sedikides, C., & Green, J. D. (2000). On the self-protective nature of inconsistency-negativity management: Using the person memory paradigm to examine self-referent memory. *Journal of Personality and Social Psychology, 79*(6), 906-922. https://doi.org/10.1037/0022-3514.79.6.906

Slamecka, N. J., & Graf, P. (1978). The generation effect: Delineation of a phenomenon. *Journal of Experimental Psychology: Human Learning and Memory, 4*(6), 592-604. https://doi.org/10.1037/0278-7393.4.6.592

Slater, M. D., Johnson, B. K., Cohen, J., Comello, M. L. G., & Ewoldsen, D. R. (2014). Temporarily expanding the boundaries of the self: Motivations for entering the story world and implications for narrative effects. *Journal of Communication, 64*(3), 439-455. https://doi.org/10.1111/j

Sui, J., & Zhu, Y. (2005). Five-year-olds can show the self-reference advantage. *International Journal of Behavioral Development, 29*(5), 382-387. https://doi.org/10.1080/01650250500172673

Syed, M. (2015). Theoretical and methodological contributions of narrative psychology to ethnic identity research. In C. E. Santos, & A. J. Umaña-Taylor (Eds.), *Studying ethnic identity: Methodological and conceptual approaches across disciplines; Studying ethnic identity: Methodological and conceptual approaches across disciplines* (pp. 27-54, Chapter xiii, 256 Pages). American Psychological Association. https://doi.org/10.1037/14618-003

Symons, C. S., & Johnson, B. T. (1997). The self-reference effect in memory: A meta-analysis. *Psychological Bulletin, 121*(3), 371-394. https://doi.org/10.1037/0033-2909.121.3.371

Thomson, D. M., & Tulving, E. (1970). Associative encoding and retrieval: Weak and strong cues. *Journal of Experimental Psychology, 86*(2), 255-262. https://doi.org/10.1037/h0029997

Trabasso, T., & Van den Broek, P. (1985). Causal thinking and the representation of narrative events. *Journal of Memory and Language, 24*(5), 612-630. https://doi.org/10.1016/0749-596X(85)90049-X

Tulving, E. (2002). Episodic memory: From mind to brain. *Annual Review of Psychology, 53*(1), 1-25. https://doi.org/10.1146/annurev.psych.53.100901.135114

Tulving, E., & Thomson, D. M. (1971). Retrieval processes in recognition memory: Effects of associative context. *Journal of Experimental Psychology, 87*(1), 116-124. https://doi.org/10.1037/h0030186

Tulving, E., & Osler, S. (1968). Effectiveness of retrieval cues in memory for words. *Journal of Experimental Psychology, 77*(4), 593–601. https://doi.org/10.1037/h0026069

Tulving, E., & Watkins, M. J. (1975). Structure of memory traces. *Psychological Review, 82*(4), 261–275. https://doi.org/10.1037/h0076782

Turk, D. J., Cunningham, S. J., & Macrae, C. N. (2008). Self-memory biases in explicit and incidental encoding of trait adjectives. *Consciousness and Cognition: An International Journal, 17*(3), 1040-1045. https://doi.org/10.1016/j.concog.2008.02.004

Turk, D. J., Gillespie-Smith, K., Krigolson, O. E., Havard, C., Conway, M. A., & Cunningham, S. J. (2015). Selfish learning: The impact of self-referential encoding on children's literacy attainment. *Learning and Instruction, 40*, 54-60. https://doi.org/10.1016/j.learninstruc.2015.08.001

Tyler, S. W., Hertel, P. T., McCallum, M. C., & Ellis, H. C. (1979). Cognitive effort and memory. *Journal of Experimental Psychology: Human Learning and Memory, 5*(6), 607-617. https://doi.org/10.1037/0278-7393.5.6.607

Warren, M. W., Chattin, D., Thompson, D. D., & Tomsky, M. T. (1983). The effects of autobiographical elaboration on noun recall. *Memory & Cognition, 11*(5), 445-455. https://doi.org/10.3758/BF03196981

Watkins, M. J., & Sechler, E. S. (1988). Generation effect with an incidental memorization procedure. *Journal of Memory and Language, 27*(5), 537-544. https://doi.org/10.1016/0749-596X(88)90024-1

Webber, C., Wilkinson, K., Duncan, L. G., & McGeown, S. P. (2022). Connecting With Fictional Characters: The Power of Books. *Frontiers for Young Minds*, *10*, [658925]. https://doi.org/10.3389/frym.2022.658925

Wechsler, D. (1997). Wechsler adult intelligence scale-third edition (WAISIII). San Antonio, TX: Psychological Corporation

Wixted, J. T. (2007). Dual-process theory and signal-detection theory of recognition memory. *Psychological Review, 114*(1), 152-176. https://doi.org/10.1037/0033-295X.114.1.152

Yin, X., Ma, Y., Xu, X., & Yang, H. (2019). The effect of self-referencing on memory for different kinds of source information. *Memory, 27*(4), 519-527. https://doi.org/10.1080/09658211.2018.1532009

Yonelinas, A. P. (2002). The nature of recollection and familiarity: A review of 30 years of research. *Journal of Memory and Language, 46*(3), 441-517. https://doi.org/10.1006/jmla.2002.2864

Yonelinas, A. P., & Parks, C. M. (2007). Receiver operating characteristics (ROCs) in recognition memory: A review. *Psychological Bulletin, 133*(5), 800-832. https://doi.org/10.1037/0033-2909.133.5.800

Yonelinas, A. P. (1994). Receiver-operating characteristics in recognition memory: Evidence for a dual-process model. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*(6), 1341-1354. https://doi.org/10.1037/0278-7393.20.6.1341