

Teenagers' memory recall of narrative writing versus informational writing and its link to emotion

Scarlet Affa¹, John Dawi², Ragheda Dawi³

¹ Burbank High School, Burbank, California

² Western University of Health Sciences, Pomona, California

³ No institutional affiliation, Burbank, California

SUMMARY

Memory, the ability to store and recall information over time, is an imperative component of our everyday lives. At first glance, the process of memorization might only be tied to studying and/or learning, but in reality, memory recall impacts every aspect of our lives. Something as simple as knowing a friend's name, requires memory recall. Hence, scientists have extensively studied memory and classified it into 3 major memory processes: encoding, retention, and recall. However, not much research has been done to determine whether the type of information that one is exposed to impacts memory recall. In this study, we investigated whether teenagers' memory recall was stronger for narrative writing or informational writing. We hypothesized that healthy male and female teenagers ages 13–19 would recall more information from narrative writing than informational writing since narrative writing promotes an emotional response. We tested this hypothesis on a group of 30 participants who read one narrative and one informational piece in counterbalanced order. After each reading period, they were given a memory test to assess their memory recall. Our results supported our hypothesis; we found that on average the participants were able to recall more information from the piece of narrative writing than the informational one. These results are significant as they indicate that emotional response could contribute to improved memory recall.

INTRODUCTION

When one recalls and says their friend's name within a second upon seeing them, they may not understand the different processes that are involved in this seemingly simple action. To them, it is a habit done without much thought. Though they may not be making a conscious effort to recall their friend's name, their memory is. The way that the brain remembers information has not been completely understood but is clearly tied to memory retention. Memory retention is the mental faculty that enables one to retain and recall previously experienced sensations, impressions, information, and ideas (1). Memory retention and recall are important for individuals of all ages to make good decisions, interact with others, and interact with their environments. Without a strong memory retention, one's quality of life is visibly impaired. Dementia is the umbrella term for memory impairments and

is a condition where individuals have impaired cognitive abilities (2). Memory impairments and dementia have often been associated with diseases, such as Alzheimer's disease (2). Patients with advanced memory disorder conditions, such as Alzheimer's disease, are usually unable to perform daily tasks such as interacting with their environment, moving, and/or eating towards the ending stages of the disease (3). Even in the absence of memory disorders that impair quality of life, healthy high school students often find it difficult to memorize or understand certain academic texts, specifically scientific ones for they tend to be more complicated (4). One would assume that someone who can memorize a hundred names and recall them within seconds must also be able to do the same with complex readings, but that is not the case.

Since memory retention plays a large role in one's life, scientists have extensively studied the types of processes involved in one's ability to memorize. The memorization process includes 3 major processes: encoding, retention, and recall (5). Encoding is the process of storing information and modifying it into a construct which can be stored in either short-term, working, or long-term memory (5). Short-term memory refers to memory which allows for the storage of a limited amount of information for a short period of time (6). This type of memory is usually employed when one needs to remember a piece of information quickly (6). For instance, remembering where one placed an object earlier engages one's short-term memory (6). Repeatedly rehearsing the digits of a phone number in one's mind upon hearing it engages one's working memory (6). Working memory, which is related to short-term memory, is usually said to be quicker and refers to the memory used while holding information in the mind in the present as demonstrated in the example of repeating the digits of a phone number (6). Long-term memory depends on the long-term storage of information, a process called memory retention (6). To illustrate, remembering what happened on one's last anniversary or birthday requires long-term memory (6). Memory retention refers to one's ability to remember stored information over a period of time (5). Finally, memory recall is the ability to retrieve information and put it to use (5).

Children and adults display differences in their memory encoding, retention, and recall. One study found that social memory develops in early childhood and that the depth of a child's memory of an encounter, its consequence, and the

emotions linked to it, are unlike that of an adult (7). Social memory refers to a person's perception of themselves as a part of a community that shares their culture (7). Children undergo various developmental changes, including changes to their memory capacity, throughout their childhood, leading to a different memory capacity from adults, who usually display a fully developed memory (8). Some studies have found that children actually demonstrate better memory precision than adults (9). Nonetheless, as children grow older, they are able to encode, retain, and recall more complex information (10). External and internal factors such as the amount of sleep one gets, mental illnesses, and the amount of previous knowledge one possesses have also proven to drastically affect memory retention and recall (11–13). Sleep has been identified as a crucial period of memory consolidation and retention since the pathways which allow one to retain and store information are maintained and formed during sleep (11). Similarly, having previous knowledge on a given topic enables one to understand, retain, and recall information more easily (13). Mental illnesses, such as depression, have proven to worsen memory retention and recall, specifically with regards to happy memories (12). To summarize, numerous factors stemming from one's current state and environment affect one's ability to encode, retain, and recall information.

Emotion also plays a large role in both attention and memory (14). Depending on the nature of the emotion (e.g., anger, happiness, or sadness), attention and memory can be improved or impaired (14). For instance, one study found that positive emotions often lead to better memory recall (14). It also found that negative emotions, such as anger, sadness, and frustration, often lead to impaired memory encoding, retention, and recall, as it becomes difficult for one to pay close attention to the information presented to them (14). These findings could be because different emotions prompt varying physiological responses, which could interfere with or amplify memory recall. Emotions can be rather subjective when assessed without physiological response markers, so it is unclear to what extent emotions can truly affect memory recall. The intensity of the emotion would also be a determining factor in its effect on memory recall (14).

However, whether the type of information that is to be memorized impacts memory encoding, retention, and recall, has yet to be completely understood. There has been a limited amount of research on this topic, and some studies have found mixed results. However, there have been studies that found that the complexity and nature (e.g., emotion-evoking, factual, fictional) of a piece of writing affect one's ability to recall information (15). For instance, fictional stories are easier to retain and recall than essays (15). Additionally, the number of details in factual and fictional texts have proven to influence memory retrieval (16). One study found that a greater number of details in both factual and fictional pieces of writing prompted better retrieval of the main points of the text (16). Though there have been studies analyzing the complexity of a text and its link to memory recall, the extent to

which different types of information affect memory encoding, retention, and recall remain unclear. Hence, the purpose of this study is to compare the memory recall of narrative writing versus informational writing in female and male teenagers, and to determine whether narrative writing is easier to recall than informational writing.

Despite the extensive research conducted on various aspects of memory retrieval, we have yet to encounter a study on the links between the specific types of writings we chose, the effect of a text's emotional appeal, and the participants' ability to retrieve information. We chose to focus on narrative and informational writings as they are among the most common texts read by teenagers in school. We hypothesized that healthy female and male teenagers ages 13–19 will recall more information from narrative writing than informational writing after reading each piece of writing once because narrative texts provide the reader with more emotion-inducing writing. Certain emotions can have a positive influence on memory recall (14). Given that narrative writing usually employs an emotional appeal and informational writing does not, we hypothesized that this factor would contribute to improved memory recall. We tested our hypothesis by assessing participants' memory recall of one informational text and one narrative text through short-response memory tests. The experiment showed that the narrative writing was in fact easier to recall as shown by the results of the memory tests from both reading periods, indicating that the emotional appeal of the narrative text could have enhanced memory recall.

RESULTS

To investigate the memory retrieval of narrative writing versus informational writing in teenagers, participants read two pieces of writing, which were comparable in length, in a counterbalanced order, then were given a test after each reading period. Questions of comparable difficulty were used for each test (**Table 1**). Respective memory tests were administered immediately after each reading period to assess how accurately participants recalled the content of the paper they had read. The average score for the narrative piece was 13.13 out of 15, meaning on average each person got about 2 questions wrong (**Figure 1**). This average stayed the same for both reading periods. The average for the informational piece was 11.6 in both reading periods (**Figure 1**). This ensured the validity of our data as both reading periods yielded the same results.

To describe our between-group data, we evaluated the ranges of scores, the medians, averages, first quartiles (Q_1) and third quartiles (Q_3) for the sets of data from both pieces. The range of scores for the narrative piece was 11–15 while the range of scores for the informational piece was 7–14. While both conditions had participants that performed well, demonstrating great memory recall, the informational piece included a lower range of scores for the majority of participants. The median for the narrative piece was 13

Questions from the Narrative Reading Memory Test	Questions from the Informational Reading Memory Test
How many people knew that the barber was a revolutionary?	According to the article, what percentage of the public is uninformed about nanotechnology?
What type of store was on the same street as the barber shop?	According to the article, what dimensions does nanotechnology deal with?
How many leaders did the customer say he captured?	According to the article, nanotechnology can be present in...
Where did Mr. Torres tell the barber to meet him later in the day?	According to the article, Nanotechnology can prevent toxicity in certain organs, but it can also...
Did the customer think that killing was an exciting and easy job?	According to the article, can nanotechnology be used to inhibit tumor growth?
Where did the barber and customer meet for the first time?	Are the risks associated with nanotechnology minimizable?
How many days old was the customer's beard?	According to the article, to which body part(s) does nanotechnology pose a threat to?
What was the customer's job?	According to the article, which factors does the toxicity of nanotech depend on?

Table 1: Memory Test Sample Questions Sample questions from both the narrative memory test and the informational memory test are presented in the table. There were 15 short-response questions in each memory recall test. Eight questions from each memory recall test were focused on assessing participants' recall of details from each text. Seven questions from each memory recall test assessed participants' memory recall of general concepts/ideas in each text.

and the median for the informational piece was 12. The first quartile, which represents the median of the 25 percentile of the set of data, was 12 for the narrative piece and 11 for the informational piece. The third quartile, representing the median of the upper half of the data, was 14 for the narrative piece and 13 for the informational piece. Overall, participants demonstrated stronger memory recall of the narrative piece.

Additionally, a two-tailed paired sample *t*-test was performed for each reading period to confirm the significance of our results. The alpha value was set at 0.05 and the *t*-test was performed once on the data sets from females from both reading periods and another time on males from both reading periods. Both *t*-tests yielded a *p*-value of 0.0276262597. The *t*-test that was done on the pooled results yielded a *p*-value of 0.00043109. The *p*-values corroborate our conclusion as they indicate a statistically significant difference between the means of the narrative and informational conditions. Hence, after reading the narrative piece, participants scored significantly higher on a subsequent memory test than after reading the informational piece. These results indicate that narrative writing is in fact easier to recall than informational writing for teenagers. 87% of female participants and 87% of male participants did better on the narrative memory test than the informational memory tests. The order in which each participant read the texts seems to not have had an influence on participants' performances because the number of participants that performed better on the narrative memory test was the same for both females and males.

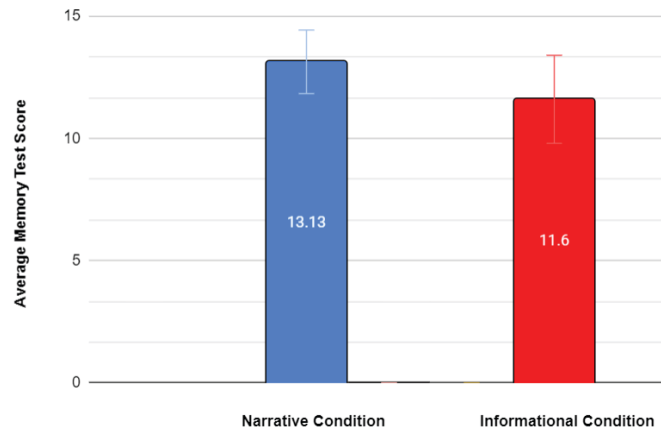


Figure 1: Mean Memory Test Scores for Narrative versus Informational Writing. A graph of the average memory test scores yielded from the narrative condition and the informational condition participants in both reading periods. Participants were given two memory tests assessing their memory recall and the mean scores from both reading periods are displayed in the graph. Statistical analysis performed by two-tailed paired sample *t*-tests, $n = 30$, $p = 0.0276262597$. The error bars represent the variability of the data and are based on each condition's standard deviation.

DISCUSSION

Our results from both reading periods showed that the teenagers scored an average of 10.2% better on the narrative memory test than the informational memory test. The score ranges from both reading periods also reiterated that participants demonstrated weaker memory retrieval of the informational piece, for their score range was 7–14. On the other hand, the narrative piece did not yield a score lower than 11, suggesting smaller variance in test performance and supporting our hypothesis that narrative writing is recalled better by teenagers than informational writing. This could be because narrative writing stirs the reader more and provides them with a more emotional appeal. Moreover, given that narrative writing provides a plot for the reader, teenagers find it easier to recall the information, sensations, and ideas that they were exposed to (17).

We randomized the trial so that the researcher did not know which text each participant read on a given day. In fact, the participants were not told what the specific hypothesis of the experiment was throughout the study to prevent any bias. This ensured that the readers did not attempt to score better on a certain memory test in order to support the hypothesis.

The emotionally appealing aspect of the narrative piece may have played a role in the stronger memory recall of the narrative piece in both reading periods. One of the biggest differences between the informational text and the narrative text was the emotional language that the narrative text employed. There have been numerous studies on the influence of emotions, both negative and positive, on memory retrieval (18-19). One study found that negative emotions, such as anger, negatively correlated with participants' ability to recall details of a given event but positively correlated with

memory retrieval of the central aspects of an event (20). Other emotions, such as fear, improved memory recall of details as well as central aspects of an event (20). Depending on the emotion and its severity, the memory process can be affected differently. To illustrate, anger often clouds one's judgment and causes them to lose their ability to judge something with reason to a certain extent (20). Fear, on the other hand, causes people to be very cautious and paranoid, allowing them to focus on small details (20). How a person acts upon experiencing a given emotion also affects the extent to which their emotions affect their memory recall (20). Ultimately, emotional responses often heighten or impair one's ability to focus and pay attention, influencing memory retention and recall by extension (20).

In addition, writing that follows a plot has shown to improve memory recall, especially when it comes to working and short-term memories (17). Narrative plots serve as frameworks for teenagers' brains, allowing them to follow along, retain, and then retrieve events or pieces of information better (17). This could be the case with the narrative piece as it entailed a plot. There are other differences between the two conditions that may have led to improved memory recall. For instance, the narrative piece employs more visual imagery since the readers must visualize the scene as they read the piece. Studies have found that visual imagery enhances memory recall (21). The narrative piece also detailed an occurrence along with background for the participants, while the informational piece elucidated facts and implications regarding nanotechnology. As previously discussed, this would heighten memory recall because of the plot aspect (17). Additionally, readers often experience different types of emotional stimulus while reading informational and narrative texts (22). Studies show that narrative writing allows readers to put themselves in the shoes of a character, leading to a better understanding of the emotional state of characters and the events of a story (23). Narrative comprehension is often driven by the simulation of realistic experiences, which elicit a better engagement from the reader (23). On the other hand, informational writing tends to lack this simulation, for it lacks depictions of events and characters and often fails to draw a lasting emotional response from the reader (22). This difference could influence a reader's engagement and level of focus while reading the two different texts, leading to better memory recall of narrative writing (23). Furthermore, the causal relations between events and sentences in a narrative text lead to better recall (24). Causal relations refer to the connections between two events or two sentences that are linked together by cause and effect or that are related by chronological order (24). Black and Bern (1981) found that readers recalled the contents of a text better when causal relations, instead of distant casual relations, were present (24). Distant casual relations refer to the type of coherence often found in informational writing (24). Though sentences are distantly linked as they refer to the same subject, they do not illustrate casual coherence as they are not events that

occurred as a result of earlier events (24). Thus, all these factors could have contributed to or been responsible for the better recall of the narrative text.

It is important to point out that our study tests working and short-term memory, so our results can not necessarily be applied to long-term memory. This becomes a limiting factor of our study as we are unable to generalize our results. Various other studies have focused on long-term memory and the influence that emotion has on retention and recall (25-26). Nonetheless, an approach similar to ours, but with a focus on long-term memory, can be applied in order to further study the topic. Additionally, there are several other limiting factors in our study. The informational article could have also been more boring for the participants, causing them to pay less attention, which would negatively affect their memory recall. Future study designs could account for participant interest beforehand in order to eliminate or diminish this aspect's influence on study outcomes. Furthermore, we were not able to use a larger pool of participants, ergo we could not run a third trial. Thus, this was a clear limitation of our study as our access to teenagers in the given age range who were willing to participate in the study was finite. The trial should be run a third time with a larger pool of participants and different types of informational articles to accommodate interest in an effort to further understand the results of the study. Further studying the extent to which emotions affect the memory process is also important. Other trials should be run with several emotionally appealing narratives with different intensities that limit other memory enhancing factors to answer that question.

In summary, participants demonstrated a relatively better memory recall of the narrative piece of writing than the informational writing. The chosen piece of narrative writing was suspenseful and relatively emotional, so this most likely contributed to the participants' ability to recall both information and sensations that they linked to the story. However, since the way that emotions influence the memory processes has not been completely understood, especially across age, we cannot make a definitive claim that this was the sole reason for our results. Future studies will help to elucidate the underlying basis for our study results.

MATERIALS AND METHODS

Thirty teenagers (15 females and 15 males) ages 13-19 were selected to participate in the study. We recruited teenagers by asking fellow healthy classmates to join the study. The average age was about 16 years old. We chose a narrative piece of writing that was about 9,000 characters in length. We made sure that it was appropriate for our participants and their reading levels by looking at the reading age for the chosen text. The narrative piece of writing used was a short story titled "Lather and Nothing Else" by Hernando Tellez (27). Since the author uses words that imply danger and descriptive language when elucidating the protagonist's moral dilemma, the story maintains a high emotional tension throughout the entire plot. Having selected the first piece of

writing, we created a 15-question memory test that assessed both the participant's recall of broad concepts and details from the text. All 15 questions were free response but they only required short answers, meaning 1-5 words, and 2 of the questions required yes/no answers. 3 questions required multiple answers. We have included some of the questions from the narrative memory test (Table 1). The informational article was titled "Do the Benefits of Nanotechnology for Medical Use Outweigh the Risks?", which was published by an organization called Race to a Cure (28). The article was somewhat scientific but did not elucidate concepts that were too complicated for our participants given their age. This text was also close to 9,000 characters in length. We ensured that the number of details/facts were approximately the same in both pieces. Another memory test that consisted of 15 equally challenging questions was created for the informational text. All of the questions were free response and required short answers of 1-5 words. Additionally, 2 of the 15 questions were yes/no questions and 3 of the 15 questions required multiple answers. We have included some of the questions from the informational memory test (Table 1). Both memory tests were not created by the researcher, but by the senior author. The senior author created the questions pertaining to details by choosing seven to eight important details from each piece and writing straightforward questions about them. The rest of the questions of each memory test were generated based upon general concepts in each piece. Since all 30 participants were going to read both texts in a counterbalanced order, there were two reading periods. 15 female participants read the informational text during the first reading period and 15 male participants read the narrative text during the first reading period. We split up the participants in this manner to be able to run paired *t*-tests using the data. The participants were given 30 minutes to read one of the articles once on a computer during the reading period. They were told to read the piece carefully and were told that they would take a timed memory test once they read the piece. Immediately after they finished reading, they were given 15 minutes to complete their memory test on a computer. The memory tests were both on Google Forms, so the data was immediately stored by the Google application. Once all the participants had finished taking their memory test, the data was then transferred to a Google Sheet, where quantitative analysis was performed. Memory was measured based on how many questions each participant answered correctly. The researcher was then told which data sets belonged to which condition for both reading periods in order to perform a quantitative analysis.

The second reading period, which occurred the day after the first, followed the same procedure with participants reading the text they did not read in the first period. Approximately 24 hours passed between the two reading periods. Both reading periods were administered in a relatively quiet room in order to avoid distractions. Three two-tailed paired sample *t*-tests were conducted on Excel at the end of the second reading period to test whether there were significant

differences in test performance after reading narrative or informational texts. One paired *t*-test was ran on the female participants' data, a second paired *t*-test was ran on the male participants' data, and a third paired *t*-test was ran on the pooled results. We ensured that no sexual dimorphisms were present by comparing each sex's recall of narrative writing to informational writing and confirming that our results did not change.

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