

Constructing a Narrative as a Means of Achieving Understanding

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by

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Abstract

The present study examined the effectiveness of constructing a narrative as a means of achieving understanding by comparing the performance of participants given two different types of writing assignments in the context of an introductory psychology class. Participants were randomly assigned to one of three writing conditions: define a set of classical conditioning terms, define a set of operant conditioning terms, or explain a set of classical conditioning terms in your own words. Participants then read their assignments aloud to a researcher. The change in score from a pre-test to a post-test was used to measure the impact of the experimental condition on participants' subsequent understanding and retention of material related to classical conditioning. The prediction that participants in the *explain classical* condition would show a greater understanding of classical conditioning, due to the construction of a narrative, was partially supported. In conclusion, the construction of a narrative may, to some extent, facilitate understanding and retention.

Constructing a Narrative as a Means of Achieving Understanding

For more than a century, the act of translating one's thoughts and emotions into words and thereby forming a narrative has been considered therapeutic, both cognitively and emotionally. Contemporary treatments of post-traumatic stress disorder, for example, often require that clients write about traumatic events in detail, thoroughly describing not just the event itself, but also their thoughts and feelings about the event as if it were reoccurring (Resick & Calhoun, 2001). Such disclosure has even been touted as a means of increasing self-knowledge. Psychologist Sidney Jourard has argued that knowledge of self requires that one make oneself known through disclosure to other people (Snyder, 1980). This process of transforming amorphous thoughts into a coherent narrative is the focus of the present study. Specifically, to what extent does this process of constructing a narrative facilitate understanding and retention?

Construction of a narrative occurs when we convey our innermost thoughts and ideas to another person, such as when we utilize another person as a 'sounding board,' and avail ourselves of the opportunity to verbalize what we are thinking. This process is not to be confused with mere introspection, which is the articulation of thought processes and/or affective judgments. A great many researchers have already focused on introspection, most using think-aloud protocols (for a review, see Wilson, 2003). Far fewer researchers have focused directly on the benefits of narrative (e.g., Pennebaker & Seagal, 1999).

The research that is available spans a continuum from studies investigating the effects of expressing one's thoughts and emotions to other people (social sharing) (e.g., Pennebaker, Zech, & Rimé, 2000), to studies investigating the effects of expressing one's thoughts and ideas in writing (writing to learn; Klein, 1999 and written disclosure; Pennebaker, 1999). Added to these

are studies suggestive of the idea that the construction of a narrative may benefit retention (depth of processing; Craik & Tulving, 1975; and the generation effect; Slamecka & Graf, 1978), complex reasoning (language and problem solving) (e.g., Baldo et al., 2004), and thought (the cognitive functions of language) (e.g., Carruthers, 2002).

Social Sharing and Written Disclosure

In the wake of an emotional experience, individuals commonly feel a strong desire to discuss their event-related thoughts and feelings with others. So much so that when a major catastrophe such as a hurricane or an earthquake strikes an entire community, mutual disclosure can, itself, become stressful. Four weeks after the Loma Prieta Earthquake, residents of San Francisco reportedly began wearing t-shirts which read, “Thank you for not sharing your earthquake experience” (Pennebaker & Harper, 1993). But the cessation of social sharing can also be calamitous, perhaps because it involves a reduction in cognitive processing. The dangers of such a withdrawal were demonstrated in a study of social sharing following the Loma Prieta Earthquake in California (Pennebaker & Harper, 1993).

Researchers in the study identified three phases of coping. In the emergency phase, social contacts increased and open expression of thoughts and feelings was encouraged, but within two weeks, mutual disclosure had become aversive and was increasingly discouraged. During this inhibition phase, discussion of the event decreased, but social conflict, nightmares, and health problems increased. In the weeks after the Loma Prieta Earthquake, Pennebaker and Harper, noted a dramatic reduction in disclosure. In a similar study, albeit one involving written rather than verbal disclosure, Cohn, Mehl, and Pennebaker (2004), noted a dramatic reduction in cognitive processing in the weeks following the September 11 attacks: a coincidence which

suggests that as individuals' tolerance for listening to others' painful stories declines, their willingness to verbalize their experiences is reduced, and ultimately so is their cognitive processing of the experience. Although this is only correlational evidence, it suggests a possible link between disclosure and cognitive processing.

Having found that disclosure is often accompanied by the re-activation of vivid imagery, upsetting emotions, and disturbing bodily sensations, Pennebaker, Zech, & Rimé (2000) wondered what sort of powerful incentive might account for individuals' initial eagerness to share their experience socially. Participants in previous studies had overwhelmingly credited social sharing with a feeling of emotional relief, so the researchers conducted a number of experiments to test whether or not emotional relief actually occurred. Finkenauer and Rimé (1998a) asked participants to recall two emotional events, one shared and one non-shared. Paradoxically, shared events were no less emotionally arousing when reaccessed than non-shared events (Finkenauer & Rimé, 1998a). In a series of follow-up studies, Rimé (1999) attempted to find a positive correlation between the amount of social sharing and the degree of subsequent emotional recovery, or alternatively a difference in emotional intensity pre- and post-disclosure. The data consistently showed that verbalizing an emotional experience does not necessarily bring about emotional recovery (Rimé, 1999). Nevertheless, participants in Rimé's studies consistently rated social sharing as emotionally beneficial (it made them feel better), and cognitively beneficial (it helped them organize their thoughts and feelings).

Rimé's participants' subjective experience of emotional relief may have been caused by other factors; a result of the passage of time, perhaps, or the process of habituation. Or, their subjective feeling of relief may have been the result of enhanced cognitive processing. Rimé's

studies indicated that non-shared memories were associated with greater search for meaning and greater efforts to understand and accommodate the event, as if further processing of non-shared memories were still needed. Such results suggest that the sharing of memories may entail cognitive processing and restructuring. In studies where participants were asked whether they still felt the need to discuss an event, a positive correlation was found between their residual need to discuss the event and their subjective feelings of incompleteness with regard to their understanding of the event.

Here may be the powerful incentive that accounts for individuals' eagerness to share their emotional experiences with others at the risk of re-experiencing painful emotions: a need for completion, colloquially referred to as "closure." According to Horowitz (1986) this need for completion, what he terms "completion tendency," stems from our psychological need to integrate new, incompatible information with our pre-existing beliefs. For both Pennebaker, Zech, and Rimé (2000) and Horowitz (1986), our eagerness to share our emotional experiences with others stems from our need to integrate and process our experiences. Perhaps social sharing, via the construction of a narrative, fosters these processes of cognitive integration, in turn creating a subjective experience of emotional relief. Others may argue that the actual, physical presence of others is what accounts for our subjective experience of emotional recovery. Research involving written disclosure, however, has demonstrated repeatedly that the actual physical presence of others is not necessary for the subjective experience of emotional recovery to occur.

In written disclosure studies, participants write down their "very deepest thoughts and feelings about the most traumatic experience of their entire life" (Pennebaker & Seagal, 1999, p.

1244). Doing so has been shown to reduce physician visits, improve immunological function, and improve mood and well-being, and has been associated with increases in grades, reductions in sick days, and better adjustment to job loss. According to Pennebaker and Seagal (1999), disclosure is particularly beneficial in the wake of chaotic, unexplained events; especially if the writing evinces clear signs of cognitive processing; specifically, a coherent reconstruction of the event with well-integrated thoughts and feelings. For Pennebaker and Seagal, the health benefits of disclosure derive from the act of constructing a narrative, a process that helps individuals understand not only their experiences but also themselves.

One of the first systematic attempts to explore the cognitive effects of disclosure involved the comparison of writing samples using computerized text analysis (Pennebaker, Mayne, & Francis, 1997). Essays from participants whose health subsequently improved were compared with essays from participants whose health remained unchanged. The computer text analysis revealed an increasing number of insight and causal words in the essays of participants whose health later improved. Their use in such essays, was later shown to be a powerful predictor of health, even more so than words expressive of emotion (Pennebaker & Graybeal, 2001). In reading participants' essays, it became apparent to the researchers that 'successful' participants were creating a story to explain and understand the event, leading at least one researcher to extol the health benefits of constructing a narrative (Pennebaker, 2000). In sum, research involving social sharing and written disclosure suggests that cognitive processing, via language, plays an integral role in emotional recovery.

The Cognitive Functions of Language

Further evidence of a connection between language and cognitive processing comes from

research suggesting that language provides humans with the ability to integrate information across various domains. According to Carruthers (2002), animals and pre-linguistic humans lack the ability to integrate different kinds of information into a single, coherent whole. For example, early humans could not have combined information relative to hunting and gathering with information relative to tool making for the purposes of designing a specialized tool. Animals cannot integrate information regarding the geometric properties of their environment with information regarding color, pattern, and smell for the purposes of accurately relocating an object. Other studies (Cheng, 1986; Hermer & Spelke, 1994) have shown that pre-linguistic children and laboratory rats rely exclusively on geometric or spatial information (as opposed to information regarding pattern or color) when disoriented in a rectangular room, whereas older children and adults are able to conjoin spatial information with object properties (e.g., a short blue wall) in order to locate a now-hidden object.

To investigate the possibility that language might account for adults' and older childrens' ability to integrate geometric and non-geometric information, Hermer-Vasquez, Spelke, and Katsnelson (1999) conducted a series of dual task experiments. Participants were asked to solve an orientation problem after being randomly assigned to one of two conditions. In one condition, participants wore headphones and repeated back what they heard (the verbal shadowing condition). In a second condition, participants wore headphones but tapped out a rhythm in time with what they heard (the nonverbal shadowing condition). The rationale behind the intervention was that verbal shadowing would inhibit internal verbal processing, which in turn would inhibit the integration of information, and ultimately lead to adverse effects on problem solving. As predicted, participants in the verbal shadowing condition, but not in the nonverbal shadowing

condition, oriented themselves like children and laboratory rats, failing to integrate different types of information in specifying the position of objects (Hermer-Vasquez et al., 1999).

Participants' poor problem-solving ability was attributed to verbal inhibition. Verbal shadowing inhibited their ability to verbalize their own thoughts internally, impaired their cognitive flexibility, and ultimately led to impairments in their ability to solve certain problems. Findings such as these suggest that language plays a direct role in problem solving.

Other findings show that when language is disrupted, either by neurological impairment or by articulatory suppression, conceptual reasoning and numerical problem solving are impaired. In a study similar to the one cited above (Baldo et al., 2005), a group of healthy participants in a verbal shadowing condition were asked to say 'na' whenever they heard a beat, another group of healthy participants in a nonverbal shadowing condition were asked to tap in response to a beat. Participants in the nonverbal shadowing condition (tappers) consistently outperformed participants in the verbal shadowing condition ("na" sayers) on tests of conceptual reasoning and complex problem solving such as the Wisconsin Card Sorting Test and Raven's Colored Progressive Matrices, demonstrating that verbal interference can impair these abilities (Baldo et al.). The researchers also found that the percentage of perseverative errors (i.e., errors resulting from participants' inflexibility in switching to new strategies) increased with participants' level of language impairment, suggesting that "flexibility and cognitive switching depend in part on language" (Baldo et al., p. 248).

Delazer, Girelli, Semenza, and Denes (1999) conducted a study investigating the effects of language impairment on numerical processing. The experimental group consisted of individuals diagnosed as aphasic. The control group consisted of healthy individuals matched for

age and education. Participants' calculation skills were assessed with a battery of problems including arithmetic facts, mental calculation, written calculation, and number composition. The researchers found a significant correlation between overall error rate and the severity of participants' language deficit, strengthening the argument that linguistic processes are supportive of numerical ability and abstract reasoning.

The aforementioned theoretical and experimental evidence suggests that language supports cognitive processing, largely by facilitating integration, problem solving, and conceptual/abstract reasoning, but the cognitive mechanisms through which this occurs are, as yet, unidentified. Using the visual system as an analogy, Carruthers (2002) theorizes that central cognition might deploy the resources of the language system to solve conceptual reasoning problems much the same way that it deploys the resources of the visual system to solve problems involving spatial reasoning. Carruthers' theory is very similar to that of Baddeley and Hitch (1974), who argued for a central executive component of working memory. At the central executive's disposal, according to Baddeley and Hitch, are slave systems consisting of a phonological loop (which supports language processing) and a visuo-spatial sketchpad. Baddeley and Hitch's slave systems are conceptually similar to Carruthers' visual and language systems, and the central executive is conceptually similar to the central cognition construct. With regard to the aforementioned experiments, the cause of the observed deficits was alleged to have been in impairment of the language system (or phonological loop).

Researchers such as Carruthers (2002), may be content to speculate about potentially unidentifiable cognitive mechanisms, but others prefer areas of research that are more empirical. Researchers interested in learning and memory, for example, have conducted hundreds of

experiments in an attempt to determine which kinds of activities and which types of processing are most conducive to learning and remembering. The results of these experiments suggest a number of possibilities. The three that are focused on here are: activity-based learning, deep (i.e., semantic) processing, and self-generation.

Cognitive Mechanisms of Learning and Memory

Activity-based learning is a method of instruction often used by educators, to “actively engage students in the construction of their own understanding” (Haigh, 2001, p. 172). Its use is based on the belief that active learning increases students' retention of course material. This belief in the efficacy of activity-based learning can be traced back at least as far as William James. In 1890, James wrote of a “curious peculiarity of memory, that things are impressed better by active, than by passive repetition” (cited in Roediger, Gallo, & Geraci, 2002, p. 320). During the next eighty-five years, activity-based approaches to learning and memory received little American attention, but in Russian psychology, where the goals and motives of the individual were considered an integral part of learning, research into activity-based learning and memory continued well into the 1960's (Roediger, et al.).

A resurgence of American interest in activity-based learning occurred with the publication of a paper by Craik and Lockhart in 1972. In their seminal article, Craik and Lockhart (1972) argued convincingly that how well information is remembered is a function of the degree to which it is analyzed. Shallow processing, attending to a word's visual or acoustic features (for example its spelling), is less likely to promote long-term recall than deep, or semantic (i.e., meaning-based) encoding (e.g., using the word in a sentence). In a second and influential article, Craik and Tulving (1975) described a series of experiments testing their depth

of processing framework. In discussing their results, Craik and Tulving concluded that, “it is the qualitative nature of the task, the kind of operations carried out on the items, that determines retention” (cited in Roediger, Gallo, & Geraci, 2002, p. 321). The type of operations most successful for better memory include not just those concerning the word's meaning, but also those requiring that the material be analyzed in depth, for example rephrasing to-be-learned material in one's own words or relating it to previously learned material.

An important caveat to their findings was later added by Morris, Bransford, and Franks (1977), who found that the superiority of meaning-based analysis could be undermined, and in fact reversed, if at test, answers required a feature-based analysis. Meaning-based analysis is only superior, according to Morris et al., if meaning is subsequently assessed by the test. Meaning-based analysis is of little use when faced with a test requiring a feature-based analysis. Morris et al.'s transfer appropriate processing framework suggests that memory is largely dependent on the specific match of processes used at encoding and processes used at retrieval (Roediger, et al., 2002). Considering that most exams are meaning-based, however, the most effective study strategy for students would be one that involves meaning-based encoding.

Empirical evidence of the effectiveness of both activity-based learning and meaning-based encoding, comes from studies involving the generation effect. The generation effect (Slamecka & Graf, 1978) refers to the observation that items generated by participants are better remembered than items they simply read. For example, participants are more likely to recall a pair of words when only the first word is given (e.g. cart-h), than when both of the words are given (e.g. cart-horse). The robustness of the effect offers evidence that active learning is preferable to passive learning. Chiaravalloti and Deluca (2002) examined the effectiveness of

self-generation as a means of maximizing new learning, and found that participants' recall and recognition of items they generated was significantly better than their recall and recognition of items that were provided. In sum, research involving learning and memory has shown that activity-based learning, semantic processing, and self-generation are all important factors for maximizing learning. A strategy which uses all three, is the construction of a narrative, the focus of the present study.

Writing-to-Learn

In the classroom, educators and education researchers in the field of education are most interested in whether activities such as writing facilitate students' understanding of course material. Education researcher Connor-Greene (2001) empirically assessed writing's effectiveness in one study and found that journal writing led to significant improvement in test scores. Students surveyed by Rickabaugh (1993) reported that writing helped them to better understand text and lecture material. Much of the research involving writing-to-learn, however, focuses on journals and writing assignments requiring that students apply the theoretical principles learned in class to their daily lives. Only a few studies (e.g., Dunn, 2000) have directly evaluated the cognitive benefits of writing by requiring students to explain a concept to another person in their own words, as did the present study. Despite the paucity of actual research in this area, educators endorse such assignments as crucial for the permanent establishment of a concept in students' minds (Aron & Aron, 2003).

Proponents of the writing across the curriculum movement, such as Emig (1977), argue that writing represents a uniquely valuable mode of learning. Citing Vygotsky (1962), Luria (1971), and Bruner (1971), Emig (1977) argues that writing, in particular, enables the full

development of higher cognitive functions such as analysis and synthesis. Citing Dewey (1938) and Piaget (1971), Emig (1977) also argues that learning and writing uniquely correspond: Learning is connective and requires the reorganization of schemas. Writing is integrative, involving the “fullest possible functioning of the brain” (p. 125) and requiring the deliberate structuring of meaning. For such reasons, Emig argues, writing is particularly useful for learning.

Klein (2000) presents four hypotheses which he believes might account for writing's contribution to learning. The first, based on Britton (1980), suggests that writing imposes explicit structure on otherwise implicit knowledge. The second is that writing gives form to ideas such that they can be reviewed, reconstructed, and built upon. The third is that writers organize elements of knowledge by virtue of the relationships among them. The fourth, based on the knowledge transforming model of Bereiter and Scardamalia (1987), suggests that writers establish goals and subgoals related to the clarification of meaning. By clarifying meaning for others, the meaning of material thereby becomes clearer for the writer as well. After conducting an analysis of the writing of elementary students, Klein concluded that the various hypotheses work together in an additive way to explain writings' contribution to learning.

Empirical evidence of writing's effectiveness on learning is limited. Butler, Phillmann, and Smart (2001) asked students in their introduction to psychology courses to respond in writing to questions regarding material recently presented in lecture. Their responses were written on index cards which were subsequently handed in. Card questions were linked to multiple choice questions on the exam. Student learning was assessed by comparing the exam scores of students in classes where the cards were used to the scores of students in classes where the cards were not used. The results suggested that there was a significant difference between the

scores of carded and non-carded students, but only with regard to exam questions that were similar to the questions whose answers had been written on the cards.

Beins (1993) used a technique of asking students to translate numerical data into words as part of their statistics assignments. The rationale for this approach was that writing would incorporate key processes identified by cognitive research as important for successful learning: active learning to facilitate deeper processing, the integration of related concepts into a coherent whole, and the repositioning of old ideas to accommodate the new. Students were specifically instructed to explain the results of their statistics assignments in a press-release format, using language easily understood by a statistically naive reader. Beins found that students given such instructions scored higher on exams and demonstrated increased ability to interpret statistical results compared to students who were simply told to write a conclusion. Similar results were found by Dunn (2000), who asked some of her students to write letters explaining statistical concepts in their own words. On the class exam, letter writers performed better than non-letter writers.

Likewise, free-writing (writing non-stop for a short interval) has been shown to lead to improvements in college students' comprehension of lecture material. Participants in a study by Hinkle and Hinkle (1990) were randomly assigned to one of four conditions. Participants in the focused thought condition were asked to concentrate on a lecture and its content, while those in the focused free-writing condition were asked to write anything as long as it was directly related to the lecture. Participants in the outlining condition outlined the contents of the lecture using their lecture notes, and those in the math problem-solving condition were asked to solve a series of math problems. On a subsequent test of comprehension, the performance of students in

both the free-writing and focused thought conditions exceeded the performance of those in the outlining and problem-solving conditions, but when testing was delayed, focused thought participants remained superior while the performance of free-writers declined to the performance problem-solvers and outliners.

Sometimes, writing-to-learn involves the use of written summaries. In a study examining the effectiveness of summary writing, Horton, Fronk, and Walton (1985) found that students who were asked to write summaries of lectures showed greater comprehension and problem solving at post-test. Foos (1995) examined the effect of summary writing on subsequent recall and recognition tests. Half of the students were assigned one summary, and were asked to summarize an entire article on the blue shark. The other students were assigned two summaries, and were asked to summarize the same article in halves, completing one summary for each half. Holding time spent summarizing constant, Foos (1995) found that completing one overall summary produced better test performance, perhaps because students who wrote only one summary were able to construct a better narrative. In sum, writing-to-learn has been linked with increased test scores and increased comprehension of course material, leading at least one researcher to state that writing, being integrative, is particularly useful for learning (Emig, 1977).

Overview of the Current Study

The primary objective of the present study was to examine the effectiveness of constructing a written narrative as a means of increasing understanding and retention of course material in an introductory psychology class. Participants were given one of three different writing assignments. Only one of the assignments required the construction of a narrative. A comparison was then made of the effect of the different writing assignments on participants'

subsequent understanding of the material. A second objective of the study was to investigate the possibility of an interaction between writing condition (i.e., define classical, define operant, explain classical) and test question type (i.e., factual/definitional, conceptual/applicational). To accomplish these objectives I chose a mixed-factor design, combining one between-subjects factor and one within-subjects factor.

The between-subjects manipulation involved three levels of writing condition: a *define operant* condition requiring that participants provide a textbook definition for a set of terms related to operant conditioning; a *define classical* condition, requiring that participants provide a textbook definition for a set of terms related to classical conditioning; and an *explain classical* condition requiring that students provide a written explanation, in their own words, for the same set of terms used in the *define classical condition*, as if to someone who had never taken a course in psychology. For all conditions, participants read aloud their written work to a researcher, ostensibly to be judged for inclusion in a study guide.

The within-subject manipulation involved two levels of question type on the pre- and post-tests: factual/definitional and conceptual/applicational. Included on the test were conceptual/applicational questions requiring a level of understanding above and beyond that acquired merely through rote learning and memorization, and factual/definitional questions that could be answered based on rote learning and memorization. Based on the number of pre-test questions answered correctly, three scores were computed. The first of these scores was a measure of their performance on the pre-test overall, in which 30 would be a perfect score. The second of the scores pertained only to the pre-test factual/definitional questions; here a perfect score would be 15. The third score reflected participants' performance only on the pre-test

conceptual/applicational questions; again, a perfect score would be 15. A similar set of scores was computed for the second quiz, and the two sets of scores were compared by computing three change scores: an overall change score, a factual/definitional change score, and a conceptual/applicational change score. These three change scores, computed by subtracting the pre-test score from the post-test score, served as the study's main dependent measures.

An additional objective of the study was to explore the relationship between various demographic variables and the study's main dependent measures (overall change score, factual/definitional change score, and conceptual/applicational change score). The additional variables included: year in college (freshman, sophomore, junior, senior, or other), class meeting time, gender, level of interest in psychology, previous experience in psychology, and grade on their instructor's in-class exam covering classical conditioning, among other topics. In addition, a 'classical conditioning only' exam grade was computed by measuring participants' performance only on the 11 questions on the instructor's in-class exam which pertained to classical conditioning.

I predicted that asking students to explain a set of terms in their own words (i.e., the *explain classical* condition) would necessarily entail the construction of a coherent narrative, and as such, would ultimately lead to a more complete and memorable understanding of classical conditioning. Specifically, I predicted that participants required to explain a concept or a set of terms in their own words, as if to another person with no previous experience in psychology, would demonstrate higher pre-test to post-test change scores, compared to the other two groups. This prediction was based on studies involving the generation effect (e.g., Chiaravalloti & Deluca, 2002), depth of processing (Craik & Tulving, 1975), and writing-to-learn (Dunn, 2000).

In fact, the *explain classical* condition was designed with the intention of maximizing the likelihood of deep, semantic processing and self-generation. Secondly, I predicted that participants in the *define classical* condition terms would show an improvement from pre- to post-test, but only on the factual/definitional questions, as suggested by the transfer appropriate processing framework. This last prediction would entail an interaction between the two factors of writing condition and question type. For the conceptual/applicational change scores, participants in the *explain classical* condition were expected to be higher than those of participants in either of the other two conditions, and for the factual/definitional change scores, participants in both the *define classical* and *define operant* conditions were expected to be higher than those of participants in the *explain classical* condition.

Method

Participants

Thirty-six participants (twelve per condition) were recruited from two undergraduate Psychology 101 classes. Thirteen of the participants were male, and twenty-three were female. There were twenty-seven freshman, seven sophomores, one a junior, and one senior. Twelve of the participants had already completed a class similar to their undergraduate Psychology 101 class, whereas 24 had never taken a psychology class before. Both of the Psychology 101 classes were taught by the same instructor, and both met on Monday, Wednesday, and Friday morning, one at 10:00 AM, and the other at 11:00 AM. Seventeen of the participants were from the 10:00 AM class and nineteen were from the 11:00 AM class.

Materials

Multiple Choice Tests

A pre- and post-test, each consisting of 15 factual/definitional and 15 conceptual/applicational multiple-choice questions, all pertaining to classical conditioning, were used. The test questions were adapted from the test bank that accompanies the Psychology 101 text (Myers, 2004) (see Appendix A). The same questions appeared on the pre-test and the post-test, but their order was rearranged.

Participant Evaluation Form

A participant evaluation form allowed participants to express their own opinion of the writing assignment's value. Additional questions on the form pertained to demographic information, and to participants' level of interest and previous experience in psychology (see Appendix B).

Procedure

Before taking part in the study participants were asked to sign a consent form and their permission was sought to allow the researcher to obtain their in-class exam grade from the Psychology 101 instructor. Participants were then randomly assigned to one of three conditions: *define classical*, *explain classical*, or *define operant*. The timing of the study coincided with the period in which classical conditioning was taught in class. Session 1, which occurred shortly before classical conditioning was to be taught, included a brief description of the study and the administration of a pre-test assessing each participant's initial level of understanding of classical conditioning. In this first session, participants were told that they must attend all classes during the week in which classical conditioning was to be taught. They were also told that in Session 2

they would write an assignment, and then read their assignment aloud to a research assistant. Participants were told that their assignments would be judged for possible inclusion in a study guide. Before taking the pre-test, participants were assured that the pre-test would in no way affect their course grade, and were asked to do their best in answering the questions, whether or not they had previously encountered the material.

Session 2 occurred five days later, after classical conditioning had been taught in class. Participants in the *define operant* condition were given forty-five minutes in which to define a set of ten terms pertaining to operant conditioning. Participants in the *define classical* condition were given forty-five minutes in which to define a set of ten terms pertaining to classical conditioning. Participants in the *explain classical* condition were asked to explain a set of terms in their own words as if to someone who had never before taken a class in psychology. The terms used in the *explain classical* condition were the same as those used in the *define classical* condition. After completing their assignments, each participant met individually with a research assistant and read his or her assignment aloud (see Appendix C for participant instructions). When participants returned the next evening for the third and final session, they were given an unannounced post-test (identical to the first except for question order), then were asked to complete the participant evaluation form. Participants were then debriefed.

Results

An alpha level of .05 was used to determine significance, and ___ was used as a measure of effect size. Following Cohen's (1988) guidelines, .10 was considered a small effect, .24 a medium effect, .37 a large effect, and .45+ a very large effect.

A 3(Writing condition: *explain classical*, *define classical*, *define operant*) X 2 (Question type: factual/definitional, conceptual/applicational) mixed factor ANOVA was computed.

Participants' change scores, computed by subtracting each participant's score (i.e. the number of questions scored correctly) on the first quiz from their score on the second quiz, served as the dependent measure.

There was no significant main effect of question type: the change scores on the factual/definitional questions ($M = 3.33$, $SD = 2.56$) did not differ significantly from those obtained on the conceptual/applicational questions ($M = 2.89$, $SD = 2.33$), $F(1, 33) = 0.67$, $p = .419$, $\eta^2 = .02$ (see Table 1). There was also no significant interaction between writing condition and question type, $F(2, 33) = 0.80$, $p = .456$, $\eta^2 = .05$. There was, however, a trend toward a significant main effect of writing condition, $F(2, 33) = 2.56$, $p = .093$, $\eta^2 = .13$. Follow up contrasts showed that participants in the *explain classical* condition ($M = 8.08$, $SD = 3.03$) outperformed those in the *define classical* ($M = 5.08$, $SD = 4.27$), $p = .045$, and also showed a trend toward outperforming those in the *define operant* condition ($M = 5.50$, $SD = 3.12$), $p = .081$.

Exploratory data analyses involved additional information provided by participants, including level of interest in and previous experience with psychology, gender, year in college, and class meeting time, as well as information provided by their instructor, namely instructor's in-class exam grade and classical conditioning-only exam grade (see Table 2). Correlation and regression analyses were conducted to examine the relationship between the variables in the study. There was a significant correlation between change scores on the factual/definitional questions and participants' level of interest in psychology, $r(34) = .372$, $p = .026$, but none between participants' level of interest in psychology and their change scores on the conceptual/applicational questions, $r(34) = .004$, $p = .982$. There was also a significant

correlation between participants' overall change scores and their classical conditioning-only exam grade, $r(34) = .356, p = .033$, but only a trend toward correlation with their overall grade on their instructor's in-class exam, $r(33) = .300, p = .075$.

Regression analysis was used to assess predictors of the classical conditioning-only exam grade. The results revealed that experimental condition was not predictive of classical conditioning-only exam grade, $F(1, 34) = 1.39, p = .247$. However, participants' overall change score was a significant predictor of classical conditioning-only exam grade, $F(1, 34) = 4.94, p = .033$. An R^2 value of .13 indicated that 13% of the variance in participants' revised grade was predicted by their change score. With regard to overall change score as the dependent variable, participant demographics, including level of interest in and previous experience with psychology, gender, class status, and class meeting time, were not predictive, even when entered into a regression model in one step, $F(1, 34) = 0.92, p = .482$.

Discussion

The present study was undertaken to determine whether construction of a narrative fosters understanding and retention of course material, in the context of an introductory psychology class. Previous research had shown that in the wake of an emotional event, disclosure, whether social or written, can facilitate cognitive processing, leading to the suggestion that the act of constructing a narrative may help individuals understand and remember events (Pennebaker & Seagal, 1999). Other research had shown that students whose work evidenced the making of novel connections, both within newly presented material and between that material and their pre-existing knowledge, performed better on tests of the material (Wong, Lawson, & Keeves, 2002). These researchers also found better test performance in students

trained to use a self-explanation procedure.

The present study attempted to replicate and extend these findings by comparing the performance of students asked to define a set of terms with the performance of students asked to explain the same set of terms in their own words, as if to someone who had never before taken a course in psychology. The design of the experimental condition (i.e., the *explain classical*), was intended to increase the likelihood of active learning, semantic processing, and self-generation, all of which are important mechanisms of learning and memory. The design of the two control conditions (i.e., the *define classical* and the *define operant*), was intended to increase the likelihood of opposing processes. The learning of this second set of participants was more passive, and their processing was relatively shallow. They simply read and copied the definitions that were provided.

The finding of greater overall change scores in the *explain classical* condition, relative to either of the other two conditions (see Table 1), provides tentative support for the principal hypothesis of the study that asking students to construct a narrative explaining complex course material in their own words would increase their understanding and retention of that material. The fact that the difference between writing conditions was a statistical trend, as opposed to a significant effect, may have been due to a lack of power. Replicating the study with a larger number of participants would increase its power, and thereby increase the likelihood of obtaining statistical significance.

Disappointingly, no support was found for the study's second hypothesis that participants in the *define classical* condition would show an improvement from pre- to post-test on the factual/definitional questions but not on the conceptual/applicational questions. Similarly, no

significant difference was found relative to question type (factual/definitional vs. conceptual/applicational) overall, nor was there a significant interaction between question type and writing condition. Participants who were asked to provide a textbook definition for a given set of terms did not perform better on the factual/definitional questions compared to the other groups, and participants who were asked to explain concepts in their own words did not perform better on the conceptual/applicational questions compared to the other groups.

The finding that participants in the *explain classical* condition had greater overall change scores is in line with the findings from the depth of processing literature (e.g., Craik & Tulving, 1975). Deeper semantic processing, involving the construction of a narrative, did lead to better recall. The failure to find either a main effect of question type or a significant interaction, however, explicitly contradicts the predictions of the transfer appropriate processing framework (e.g., Morris, Bransford, & Franks, 1977). Participants who copied (i.e., encoded) the course material in a definitional format did not perform better when questions also were in a definitional format. Nor did participants who semantically processed the course material in a conceptual format perform better when questions were also in an applicational format. Participants' question-answering performance was unaffected by question type.

With regard to the exploratory analyses, very little relationship was found between the demographic variables and the main dependent variables in the study (i.e., overall change score, factual/definitional change score, conceptual definitional change score, instructor's in-class exam grade, and classical conditioning-only exam grade). The only significant relationship was between participants' level of interest in psychology and their change scores on the factual definitional questions, suggesting that whether or not a student is interested in psychology does

predict test performance but only at the level of learning which involves facts and definitions. The finding of a significant correlation between participants' overall change scores and their classical conditioning-only exam grades was somewhat surprising given the rather large ceiling effect exhibited by the second of these two data sets. Similarly, the lack of correlation between participants' overall change scores and their instructor's in-class exam grades was not surprising given that their exam grades were influenced by factors outside the experimental conditions (i.e., many questions pertained to topics other than classical conditioning).

A further evaluation of the effectiveness of constructing a narrative was made using participants' subjective assessments of the written assignments. On the participant evaluation form (see Appendix B), participants were asked three questions. The first question asked whether he or she felt that the writing assignment involved too much work. The second asked whether he or she felt that the writing assignment increased their understanding of the material. The third asked whether the participant felt that the assignment would help him or her perform better on the exam. Participants responded to the questions by marking a five-point scale. Points ranged from strongly disagree (1) to strongly agree (5). While some of the students indicated that they felt the assignments involved too much work (38.9% marked a 3-agree or higher), most disagreed (61.1% marked a 1 or a 2). The majority of participants indicated that they believed that the assignment would increase their understanding of the course material (91.5% marked a 3-agree or higher); and, a majority of participants indicated that they expected that the assignment would help them to perform better on upcoming exams (77.8 % marked a 3-agree or higher). Unfortunately, because participants' responses on the evaluative items (but not the demographic items) was anonymous, no comparison could be made of the responses between the

three writing conditions.

A few students provided additional comments. One student commented that the quiz was too long. Two others weighed in on the effectiveness of copying definitions as a method of learning new material. The first of these students said that she learned more in class than she did from copying the definitions. The other student, presumably, held the opposing view. She commented that she routinely writes down definitions as she reads. Interestingly, the results of the study indicate that the mere copying of definitions offers little to no advantage.

With regard to the higher test scores of participants in the *explain classical* condition, there is at least one possible alternative explanation: participants in the *explain classical* condition may have expended more effort than participants in the *define operant* or *define classical* conditions. The grades participants received on the written assignments, however, dispute this argument. After reading their assignment aloud, participants handed their assignment to the attending research assistant. The research assistant immediately graded the assignment on a scale of 1 (incomplete) to 3 (complete). The research assistants were specifically instructed by the researcher to assign a score of 3, only to fully sincere attempts to complete the assignment, half-hearted attempts were to be assigned a score of 2, and grossly poor attempts were to be assigned a score of 1. With only three exceptions, participants' assignments were all judged to be complete and fully sincere attempts to comply with the instructions. In fact, the three exceptions (all two's) had been written by participants in the *explain classical* condition. Nonetheless, the fact that the difference between writing conditions was a statistical trend, as opposed to a significant effect, cannot be ignored. Further research with a larger sample size and a wider variety of topics is required to determine with more certainty whether the construction of a

narrative facilitates understanding and retention.

Overall, the results of the study suggest that asking students to explain complex course material in their own words, as if to someone with little or no experience in psychology, is fairly effective as an instructional strategy, at least compared to the strategy of asking students to copy textbook definitions. Interestingly, Beins (1993), whose study found that students asked to summarize their statistical data in writing, without using statistical terminology, developed better computational and interpretive skills, came to a similar conclusion. Since then, Beins has used a variation of his experimental manipulation as an instructional strategy, asking his students to translate journal articles into jargon-free language. Students, like the one mentioned in the previous paragraph, who routinely copy textbook definitions as a method of learning new material, may want to re-think their strategy. And instructors may want to encourage the use of alternative assignments, such as the construction of a narrative. In sum, the results of the study are of value to both students and teachers.

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Appendix A

Test on Classical Conditioning

Using the #2 pencil provided, please answer the following questions regarding classical conditioning.

1. In classical conditioning, a stimulus that naturally and automatically triggers a response is called a(n):
 - A) Unconditioned Response (UCR).
 - B) Unconditioned Stimulus (UCS).
 - C) Conditioned Response (CR).
 - D) Conditioned Stimulus (CS).
2. The reappearance, after a time lapse, of an extinguished conditioned response (CR) is called:
 - A) generalization.
 - B) spontaneous recovery.
 - C) acquisition.
 - D) discrimination.
3. If a ringing bell causes a dog to salivate because the bell has been regularly associated with food in the mouth, the unconditioned response (UCR) is the:
 - A) ringing bell.
 - B) salivation to the ringing bell.
 - C) food in the mouth.
 - D) salivation to the food in the mouth.
4. A real estate agent showed Gavin several pictures of lakeshore property while they were eating a delicious, mouth-watering meal. Later, when Gavin was given a tour of the property, he drooled with delight. For Gavin, the lakeshore property was a:
 - A) Unconditioned Stimulus (UCS).
 - B) Conditioned Stimulus (CS).
 - C) Unconditioned Response (UCR).
 - D) Conditioned Response (CR).
5. After recovering from a serious motorcycle accident, Gina was afraid to ride a motorcycle but not a bicycle. Gina's pattern of fear best illustrates:
 - A) generalization.
 - B) acquisition.
 - C) spontaneous recovery.
 - D) discrimination.

6. Male Japanese quail became sexually aroused by a red light that had previously been associated with the presentation of a female. In this instance, the female quail is a(n):
 - A) Unconditioned Response (UCR).
 - B) Unconditioned Stimulus (UCS).
 - C) Conditioned Response (CR).
 - D) Conditioned Stimulus (CS).
7. The initial stage of classical conditioning during which a response to a neutral stimulus is established and gradually strengthened is called:
 - A) Association.
 - B) Acquisition.
 - C) Generalization.
 - D) Discrimination.
8. The infant Albert developed a fear of rats after a white rat was associated with a loud noise. In this example, Albert's fear of the white rat was the:
 - A) Unconditioned Stimulus (UCS).
 - B) Unconditioned Response (UCR).
 - C) Conditioned Stimulus (CS).
 - D) Conditioned Response (CR).
9. In Pavlov's experiments on the salivary conditioning of dogs, the conditioned stimulus (CS) was:
 - A) the taste of food.
 - B) salivation to the taste of food.
 - C) the sound of a tone.
 - D) salivation to the sound of a tone.
10. Long after being bitten by a stray dog, Alonzo found that his fear of dogs seemed to have disappeared. To his surprise, however, when he was recently confronted by a stray dog, he experienced a sudden twinge of anxiety. This sudden anxiety best illustrates:
 - A) acquisition.
 - B) generalization.
 - C) spontaneous recovery.
 - D) extinction.
11. The tendency for a CR to be evoked by stimuli similar to the CS is called:
 - A) spontaneous recovery.
 - B) discrimination.
 - C) acquisition.
 - D) generalization.

12. In classical conditioning, the unlearned, naturally occurring response to an unconditioned stimulus is called the:
- A) Unconditioned Stimulus (UCS).
 - B) Unconditioned Response (UCR).
 - C) Conditioned Response (CR).
 - D) Conditioned Stimulus (CS).
13. A patient who had long feared going into elevators was told by his therapist to force himself to go into 20 elevators a day. The therapist most likely wanted to encourage the _____ of the patient's fear.
- A) generalization
 - B) acquisition
 - C) discrimination
 - D) extinction
14. In Aldous Huxley's *Brave New World*, infants develop a fear of roses after roses are presented with electric shock. In this fictional example, the presentation of roses is the:
- A) CS.
 - B) UCS.
 - C) UCR.
 - D) CR.
15. Because of the discomfort and embarrassment associated with his childhood bedwetting, Andrew becomes nervous whenever he has the urge to urinate. If genital arousal subsequently makes Andrew unusually anxious, this would best illustrate:
- A) generalization.
 - B) acquisition.
 - C) spontaneous recovery.
 - D) discrimination.
16. In Pavlov's experiments, the taste of the food triggered salivation in a dog. The food in the dog's mouth was the:
- A) UCS.
 - B) UCR.
 - C) CS.
 - D) CR.
17. Two-year-old Philip was recently clawed by the neighbor's cat, Whiskers. Philip's newly developed tendency to fear all small animals demonstrates the process of:
- A) generalization.
 - B) acquisition.
 - C) extinction.
 - D) discrimination.

18. In classical conditioning, the learned response to a previously neutral conditioned stimulus is a:
 - A) UCS.
 - B) UCR.
 - C) CS.
 - D) CR.
19. Which of the following is an unconditioned response?
 - A) salivating at the sight of a lemon
 - B) raising your hand to ask a question
 - C) jerking your hand off a very hot stove
 - D) walking into a restaurant to eat
20. During extinction, the _____ is omitted; as a result, the _____ seems to disappear.
 - A) UCS; UCR
 - B) CS; CR
 - C) UCS; CR
 - D) CS; UCR
21. Spontaneous recovery refers to the:
 - A) expression of learning that had occurred earlier but had not been expressed because of lack of incentive.
 - B) organism's tendency to respond spontaneously to stimuli similar to the CS as though they were the CS.
 - C) return of a response after punishment has been terminated.
 - D) reappearance, after a rest pause, of an extinguished CS.
22. A child's fear at the sight of a hypodermic needle is a(n):
 - A) CR.
 - B) UCS.
 - C) CS.
 - D) UCR.
23. The ability to distinguish between a conditioned stimulus and similar stimuli that do not signal an unconditioned stimulus is called:
 - A) generalization.
 - B) acquisition.
 - C) discrimination.
 - D) extinction.

24. In classical conditioning, the _____ signals the impending occurrence of the _____ .
- A) UCS; CS
 - B) UCR; CR
 - C) CS; UCS
 - D) CR; UCR
25. When a CS is not paired with a UCS, the subsequent fading of a CR is called:
- A) generalization.
 - B) acquisition.
 - C) spontaneous recovery.
 - D) extinction.
26. In classical conditioning, an originally irrelevant stimulus that, after association with an unconditioned stimulus, comes to trigger a conditioned response is a:
- A) UCS.
 - B) UCR.
 - C) CS.
 - D) CR.
27. The occurrence of spontaneous recovery suggests that during extinction the _____ is _____ .
- A) CS; eliminated
 - B) CR; eliminated
 - C) CS; suppressed
 - D) CR; suppressed
28. Toddlers taught to fear speeding cars may also begin to fear speeding trucks and motorcycles. This best illustrates:
- A) generalization.
 - B) acquisition.
 - C) spontaneous recovery.
 - D) extinction.
29. A dog's salivation at the sight of a food dish is a(n):
- A) CS.
 - B) UCS.
 - C) UCR.
 - D) CR.
30. Which of the following provides evidence that a conditioned response (CR) is not completely eliminated during extinction?
- A) acquisition.
 - B) generalization.
 - C) spontaneous recovery
 - D) discrimination.

Appendix B

Participant Evaluation Form

Please answer the following questions about yourself.

1. Are you a: freshman sophomore junior senior other
2. What is your gender? Male Female
3. What is your level of interest in psychology?
 very low low moderate high very high
4. What time is your PSYC 101 class? 10:00AM 11:00AM
5. Have you ever taken a class similar to PSYC 101 in high school or at another college?
 Yes No

Please answer the following:

1. The writing assignment involved too much work.
 Strongly disagree Strongly agree
 1 2 3 4 5
2. The writing assignment increased my understanding of the material.
 Strongly disagree Strongly agree
 1 2 3 4 5
3. The writing assignment will help me perform better on the exam.
 Strongly disagree Strongly agree
 1 2 3 4 5

Additional comments:

Appendix C

Participant Instructions

Session 1

Participants are required to attend all PSYC 101 classes this week. If you are unable to attend class because of an illness or an excused absence, please notify Dr. May.

Participants are also required to attend two additional sessions on Monday and Tuesday of next week. Both sessions will begin at 8:00 pm. Monday's session will last approximately forty-five minutes, whereas Tuesday's session will last approximately thirty minutes. All sessions will be held in Bartlett 166. **Please bring your PSYC 101 text with you to Session II on Monday.**

*Session 2*A. Instructions for participants in the *define operant* condition:

Using your PSYC 101 text (Myers, 2004), please provide a textbook definition for the following terms: Operant Conditioning, Respondent Behavior, Operant Behavior, Thorndike's Law of Effect, Shaping, Reinforcer, Primary Reinforcer, Conditioned Reinforcer, Continuous Reinforcement, and Partial Reinforcement. **Please work quietly and independently.**

The approximate length of the assignment should be one page. You will have forty-five minutes in which to complete the assignment, after which you will be asked to present the assignment orally to a research assistant. **Don't forget** - the third and final session is tomorrow, Tuesday at 8:00 pm in Bartlett 166.

Here is an example from the chapter on Consciousness:
Psychoactive Drug A chemical substance that alters perception and mood.

B. Instructions for participants in the *define classical* condition:

Using your PSYC 101 text (Myers, 2004), please provide a textbook definition the following terms: Classical Conditioning, Unconditioned Response, Unconditioned Stimulus, Conditioned Response, Conditioned Stimulus, Acquisition, Extinction, Spontaneous Recovery, Generalization, and Discrimination. **Please work quietly and independently.**

The approximate length of the assignment should be one page. You will have forty-five minutes in which to complete the assignment, after which you will be asked to present the assignment orally to a research assistant. **Don't forget** - the

third and final session is tomorrow, Tuesday at 8:00 pm in Bartlett 166.

Here is an example from the chapter on Consciousness:

Psychoactive Drug A chemical substance that alters perception and mood.

C. Instructions for participants in the *explain classical* condition:

Please explain classical conditioning, in writing, **as if to someone who has never taken a course in psychology**. Be sure to include (and explain in your own words), the following terms: Classical Conditioning, Unconditioned Response, Unconditioned Stimulus, Conditioned Response, Conditioned Stimulus, Acquisition, Extinction, Spontaneous Recovery, Generalization, and Discrimination. **Please work quietly and independently.**

The approximate length of the assignment should be one page. You will have forty-five minutes in which to complete the assignment, after which you will be asked to present the assignment orally to a research assistant. **Don't forget** - the third and final session is tomorrow, Tuesday, at 8:00 pm in Bartlett 166.

Here is an example from the chapter on Consciousness:

Psychoactive Drug A drug which alters our perception of reality and affects our mood.

Table 1

Means (Standard Deviations) of Change Scores on the Classical Conditioning Tests

Condition	Overall Change	Factual Change	Conceptual Change
Explain classical	8.08 (3.03) ^a	4.75 (2.01) ^b	3.33 (2.15)
Define classical	5.08 (4.27)	2.50 (2.61)	2.58 (2.50)
Define operant	5.50 (3.12)	2.75 (2.60)	2.75 (2.45)

^a Contrasts revealed a significant difference between the *explain classical* and *define classical* conditions, $p = .045$, and a trend toward a significant difference between the *explain classical* and *define operant* conditions, $p = .081$.

^b Contrasts revealed a significant difference between the *explain classical* and *define classical* conditions, $p = .029$, and a marginally significant difference between the *explain classical* and *define operant* conditions, $p = .051$.

Table 2

Means and Standard Deviations of Demographic Variables

Variable	<i>M</i>	<i>SD</i>
Instructor's in-class exam grade ^a	82.89	10.80
Define Classical	77.50	12.97
Explain Classical	87.67	8.17
Define Operant	83.50	8.91
Classical conditioning-only exam grade ^b	10.40	0.88
Define Classical	10.08	1.08
Explain Classical	10.58	0.52
Define Operant	10.50	0.91
Interest in psychology ^c	3.17	0.71
Define Classical	2.92	0.52
Explain Classical	3.17	0.58
Define Operant	3.50	0.91

^aMaximum score = 100^bMaximum score = 11^c1 = Very low, 2 = Low, 3 = Moderate, 4 = High, 5 = Very high

Table 3

Pearson Correlations for Demographic Variables and In-class Exam Grades

Variable	1	2	3	4	5
1. Year in college	--	-.14	-.18	.26	.16
2. Interest in psychology		--	.03	-.02	-.22
3. Previous experience in psychology			--	.21	.11
4. Instructor's in-class exam grade				--	.56*
5. Classical conditioning-only exam grade					--

* $p < .01$