Levels of Processing

Katie Crum
Abstract

We collected three groups of undergraduate participants in classroom settings to test levels of processing in three different circumstances: low-level, medium-level, and deep-level processing. During each circumstance, participants were required to complete a word-based activity that called for the implementation of one of the three levels of processing. Following the activity, participants were given an unexpected free recall test on the words they had been exposed to. The hypothesis of this study predicted that utilizing deeper levels of processing during learning would allow for better recall of information. However, we found that participants recalled the highest number of words during the medium-level processing activity rather than during the deep-level activity. Possible explanations for these findings will be discussed.
Levels of Processing

The Levels of Processing theory suggests that memory is based on the depth of procedures used during intake of information. There are three levels: shallow, medium, and deep processing. Low-level processing focuses on external characteristics of a word or item and little on meaning. Deep-level processing focuses almost entirely on meaning and also the item’s or word’s relationships to other items or words. In this way, it is hypothesized that activities that involve deep-level processing will be remembered more easily than activities that involve low-level processing (Craik and Lockhart, 1972; as cited in Goldstein, 2014). A study by Craik and Tulving (1975) at the University of Toronto consisted of ten separate experiments in which variables were altered in each to determine whether deeper processing methods would result in higher word retention, and to eliminate the idea that time spent analyzing a word list makes a difference in retention. Craik and Tulving’s research suggested the same findings as was hypothesized: that lower-level processing would result in less retention than deeper-level processing techniques. Participants in Craik and Tulving’s study were able to recall, or remember, more words when they completed a meaning-based, or deep-processing task, regardless of other variables such as time spent looking at each word, knowledge of the recall test, or trial setting.

We were interested in this research because it is invaluable for students to understand that it is the method in which one manipulates information to understand its’ meaning rather than the time spent studying information that is important in order to remember it later on, such as for an exam or speech. Many students might not be displaying their best work in school simply because they don’t know how to study.
Method

Participants

All participants were undergraduate students at Penn State York, recruited by a paper sign-up sheet given to Introduction to Psychology students. Participants were of mixed racial backgrounds but predominantly white. The low-level circumstance included 9 participants, consisting of 7 women and 2 men; the medium-level circumstance included 3 participants, consisting of 2 women and 1 man; and the deep-level circumstance included 9 participants, consisting of 7 women and 2 men.

Materials

Each trial took place in a classroom setting. We used three PowerPoint slideshows, one for each level of processing, which contained the same 60 words, one on each slide. The words were randomly selected using an online word generator. The PowerPoint presentations were timed to change slides after a specific number of seconds. Participants wrote their answers for the assigned activity by hand on sheets of paper, and also performed the recall test on the back of the same sheets of paper.

Procedure

During the low-level processing circumstance, participants were incorrectly informed that we would be testing their ability to retain and implement items in short-term memory. Each participant was exposed to 60 words on a PowerPoint slideshow displayed by an overhead projector. Each word was shown for 1 second. After the word was revealed, participants had 3 seconds to write down how many syllables the word contained. For example, the word dog has one syllable, table has two, etc. Afterwards, participants were asked to flip over their papers and write down as many words as they could recall in any order.
During the medium-level processing circumstance, participants were also incorrectly informed that we would be testing their ability to retain and implement items in short-term memory. Each participant was exposed to 60 words on a PowerPoint slideshow displayed by an overhead projector. Each word was shown for 1 second. After the word was revealed, a category was displayed. Participants had 5 seconds to write down yes, if the exposed word fit into the presented category or no, if the word did not fit into the presented category. For example, if the word *horse* appeared, followed by the category, *barnyard animals*, the answer would be yes because the word fits into the category. Afterwards, participants were asked to flip over their papers and write down as many words as they could recall in any order.

During the deep-level processing circumstance, participants were again incorrectly informed that we would be testing their ability to retain and implement items in short-term memory. Each participant was exposed to 60 words on a PowerPoint slideshow displayed by an overhead projector. Each word was shown for 1 second. After the word was revealed, either the word *synonym* (a word that means the same as) or *antonym* (a word that means the opposite of) was displayed. Participants had 5 seconds to write down either a synonym or an antonym for the exposed word based on the instructions from the screen. For example, if the word *terrified* appeared, followed by the word *antonym*, participants might have written the word *brave* on their answer sheets. Afterwards, participants were asked to flip over their papers and write down as many words as they could recall in any order.

Results

Unfortunately, we did not find the expected results. According to previous studies, participants that engaged in low-level processing activities should have recalled the least number of words, and participants that engaged in deep-level processing activities should have recalled
the greatest number of words, with medium-level processing activity recall falling in-between. Instead, we found a close similarity in recall among all three levels of processing. An ANOVA was conducted on the recall data and revealed no significant differences, $F(2, 18) = 3.02$, $p = .07$. As shown in Figure 1, participants using shallow processing recalled 9.7% of the words, participants using medium processing recalled 17.0% of the words, and participants using deep processing recalled 15.1% of the words.

**Discussion**

There are a number of reasons why we may not have gotten our desired results. One limitation is that we failed to control for the number of participants in each circumstance. Not all participants who were signed up for each trial showed up on their designated day, resulting in inconsistent and small numbers of participants for each trial. The numbers therefore were not enough to give us accurate or significant data. Even in the small trends that we found among trials, there were multiple outliers. For example, some participants recalled more words in the low-level activity than participants recalled in the deep-level activity, which as previously stated, is not consistent with our hypothesis or with previous research. If there had been more participants in each circumstance, we may have found clearer trends. However, there is also a chance that the activities we chose for each circumstance were not successful. For example, the low-level processing activity obviously resulted in the least recall because it was not meaning-based. Creating a medium-level and deep-level processing activity was more difficult because it was challenging to distinguish between what would truly require medium-processing and what would require much deeper processing. One criticism of Craik and Tulving’s work is that there is no clear definition between the different levels of processing and that is may be contextual, meaning that the level of processing required for a task may differ from person to person, as
suggested by Eysenck and Eysenck (1980). Eysenck and Eysenck agree with Craik and Tulving that deeper semantic tasks result in better recall of words, but what they suggest is that the distinction between these levels is that a medium-level activity includes a distinct phonemic, or word-based external, quality along with some semantic quality. For example, Craik and Tulving used rhyming as their medium-level processing circumstance. Rhyming includes a phonemic quality (the rhyming) and a semantic quality (the participants created a rhyming word based on their experiences with other words). We propose that it may be that our medium-level activity of categorization actually required equal levels of processing as our deep-level activity of synonyms/antonyms. If we analyze these categories further we can see why this may be a possibility: categorization and synonyms/antonyms both require two semantic connections. In categorization, you need to understand the meaning of the word given and also the meaning of the category given. There are no phonemic observations being made in this activity. In the synonyms/antonyms activity, you need to understand the meaning of the word given and also the meaning of a possible synonym or antonym of that word. Again, there are no phonemic observations being made here. Therefore, we can suggest that both of these activities may require deep levels of processing, which is why our medium-level circumstance actually resulted in higher recall of words even with fewer participants than the deep-level circumstance. Conducting more research about the distinction between the levels of processing and gathering more participants may have made our study more accurate.

Another limitation was a possible problem with the deep-level processing activity itself. When we spoke to some of our participants after the study, they informed us that they had a difficult time thinking of synonyms and antonyms to some of the words on the word list. Even though finding the correct answer to the activity was not the primary intent, this challenge may
have resulted in less retention of words because the participants were unable to make any semantic connections to the words when they couldn’t come up with an answer. We had predicted that participants might have had a hard time thinking of answers for the synonym/antonym activity, but we did this so that all sixty words would be the same for each level of processing circumstance, in order to be sure that the selected words were no more difficult or easy to remember in each trial. Nevertheless, this may be another explanation as to why the deep-level processing results showed less recall than medium-level processing.

What we did control for in the study was word rehearsal and time spent viewing each word. Potential rehearsal was controlled by misleading participants about the purpose of the experiment and keeping them uninformed about the memory test following the trial. Also, the PowerPoint presentations were on a timer so that participants did not have any down time to think about the words. This method helped demonstrate that time spent studying the words was not the cause of our results. However, previous research suggests that these variables do not make a difference in word retention. For example, in a study by Chaffin and Herrmann (1983), word lists were read to students in a classroom setting. During some trials, students were asked to repeat the words before being given a recall test, while others were asked to repeat the word “hello” for 15 seconds aloud while creating images for the words in their heads, before being given the recall test. Even when students were able to rehearse the words for a period of time, recall was still better for the group who used imagery because it was a semantic method of processing the information. Words that were recalled using the rehearsal method were most likely only being stored in short-term memory and would not transfer to long-term memory unless they were more deeply processed. Chaffin and Herrmann’s research not only suggests that it may not have been necessary for us to control for word rehearsal, but it supports our finding
that low-level processing results in less retention of words because the words that were recalled were most likely being retained in short-term memory. Due to retroactive interference, the idea that newly learned information interferes with the retrieval of previously learned information, participants had forgotten a majority of the words by the time the recall test had been given.