Stress and Working Memory

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Abstract

Previous research suggests physical stress has an impact on a person's memory. In order to better illustrate the impact, this study focuses on the link between stress and auditory working memory. Working memory describes the ability to take in information, hold it for a short period of time, and then utilize that information on a subsequent task. Deficits in this specific type of memory can impact a person's ability to follow directions and maintain conversation, along with other components of daily functioning. In the classroom, this can appear as difficulties finishing assignments with multiple steps or trouble maintaining engagement during a lecture. During the study, participants (N=43) were divided into two groups. One group was exposed to stress (plunged their hand into an ice bath), while the other group did not undergo any directed stress. Both groups were read a list of words from the Deese, Roediger, and McDermott (DRM) task and after 15 seconds were asked to write down as many of the words as they could remember. The mean number of words remembered by each group was compared and results showed the ice bath had a significant effect on the participants' auditory working memory. These observations add to the body of research regarding the negative effects of stress on working memory.

Background

Previous research supports a relationship between stress and working memory (Zhong et al., 2018).

Williams (2022) found that administering cold temperatures can result in the release of stress hormones and cause the body to go into a state of stress.

While the DRM task is traditionally used to assess false memories, researchers in this study focused on the first task which relates to immediate recall.

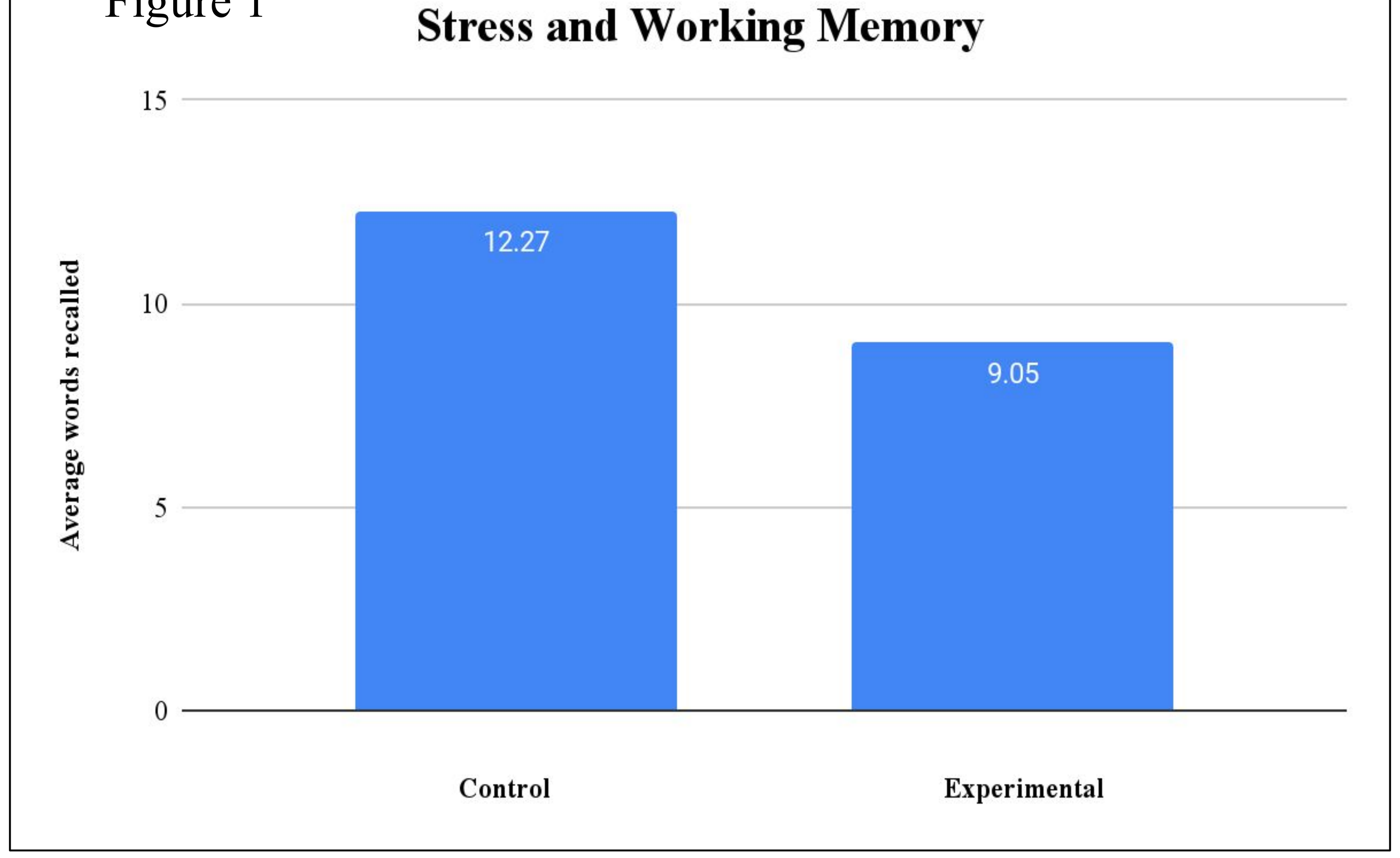
"Working memory is defined as a processing resource of limited capacity, involved in the preservation of information while processing the same or other information" (Swanson el al., 2009).

Parts of the brain like the hypothalamus, effect the degree of impactful stress has on immediate recall abilities. Immediate recall tests are seen to be effective in establishing long term memory as well (Wolf, 2012, p. 272).

A study conducted with college students by Payne et al. (2002) demonstrated a decreased ability to recall reading materials, lectures, and even personal experiences after they underwent a high-stress situation (Payne et al., 2002).

Hypothesis: The results of this study will contribute to the body of knowledge regarding the relationship between stress and working memory. We expect to find those exposed to a stressful situation will have a harder time recalling the words stated as compared to those who were not exposed to stress.

Figure 1



Methods

Participants: 43 undergraduate students, over the age of 18, from Carroll College

Measurements: Deese Roediger and Mcdermott Task (DRM)

Procedure: Participants were randomly assigned to either the control or experimental group, based on if their participant number was odd (control) or even (experimental).

Participants in the experimental group submerged their non-dominant hand in an ice bath to induce stress. This was done while they were read the DRM list aloud.

Each group listened to a list of 20 words and were asked to remember as many as they could. Both groups waited 15 seconds after the DRM lists were read and then wrote down all the words they were able to remember.

The number of words accurately recalled were recorded.

A t-test was used to compare mean scores of total number of words remembered for both groups.

Results

There is a significant difference between the average scores of the conditions (p = .0011).

Participants in the control group demonstrated higher levels of immediate recall (mean = 12.27 words recalled) as compared to the group under the stress condition (mean = 9.05 words recalled).

Conclusion

Results show stress from an ice bath had an effect on Carroll College students' ability to recall a list of words read aloud. Our hypothesis was supported as the group exposed to stress while being read the DRM list showed diminished working memory as compared to to the control group.

This current study evaluates the potential impact of stress on working memory. Similar to other previous studies examining memory and stress, a DRM memory task was used. Initially, researchers conducted two separate memory tasks on each group to also examine false memories; however, due to procedural error, only data from the initial memory tasks was analyzed.

The average words (mean = 12.27) correctly remembered by the control group (non-stress group) was found to be significantly higher than those who were exposed to the stressor (mean = 9.05). Results indicate, stress had an effect on participants working memory.

These results provide knowledge about the daily impact of stress on working memory. With college being a high-stress environment, many students may have decreased working memory capability when attending multiple classes, taking exams, and writing papers.

There is potential for more research in the future involving the impacts of stressful stimuli and stressful situations on working memory. In this study, participants were exposed to the physical stressor of ice water submersion of their non-dominant hand. This research supports prior findings and encourages more research related to emotional and social stressors and their impacts on working memory.