Research on the Influence of Stress on the Examination Results of Undergraduates

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ABSTRACT
Most of the students are not able to perform well in their exams, and we want to figure out why things happen like this. The study, through experiments, assessed impairments on working memory functionality due to heightened levels of stress. We hypothesized that difficult working memory tasks would elicit a greater stress response in participants with prior chronic stress. Undergraduate college students (N=40) were randomly assigned to one of two different conditions presenting at different levels of difficulty. Participants were asked to complete surveys on their perceived stress levels both from the past month and presently. Participants were then prompted to complete tasks to engage working memory at different levels of difficulty depending on group assignments. The results showed that the more difficult working memory task significantly increased the stress of participants.

Keywords: *undergraduate students, level of stress, tests, working memory*

1. INTRODUCTION

Tests, as the most popular forms of performance evaluation, will bring people a lot of stress. Those stress often affects individual's emotional status, and severely, it can result anxiety. Especially in school, students take exams very often. The possibility to have exam stress or task anxiety is higher than most people. At the same time, Zeidner has proposed his idea that test anxiety is the emotional, physiological, and behavioral responses of exams[1]. Most of test-anxiety responses were negatively impacted to students. Test stress and test anxiety will cause damage to individual's cognition, emotion, and psychological state. Based on those previous study results, we considered that anxiety is connected to stress. The more stressed individual are, the more possible he or she will get anxiety disorder.

We start our idea by predicting that there is some relationship between stress and study performance. Tests is the high-stakes situation for students. Akinola et al. suggested that stress and anxiety is connected and closely related[2]. We thought the suggestion that anxiety evoked by lots of stress have the relationship with student's performance is reasonable. Furthermore, memory is an important cognitive function that can be affected by stress. Besides, working memory is the field that researchers concerned often in recent years. We planned to set up working memory tests to compare and analyse whether undergraduate students will be affected during the condition of different anxiety levels.

Prior studies have proposed many meaningful WM models to test working memory functions and performances. Baddeley and Hitch has posted three complement model of working memory [3]. Based on this model, Ma et al. presented five working memory tests [4]. We inspired by those tests and applied in our later experimental processes.

According to those studies, we conducted three hypothesis: (1) All of the participants would become more stressed after taking WM tests. (2) Students who have already suffered chronic stress would perform worse than students who did not. The more stressed the participant was, the worse his or her performance would be. (3) Students who took easier working memory test will perform better than student who took harder memory test.

Stress is so close to students' daily life. After finishing the study, we want to find out if there is any solution that could reduce students' stress and pressure caused by schools, decreasing the possibility to cause anxiety disorder among students. We also want to find the ways to improve individual's working memory, in order to help students to learn easier at school.

2. RESEARCH METHODS

2.1. Participants

To generalize our desired population of US college students, we used a sampling frame of every student enrolled in Psychology Participation Pool at the University of Connecticut. There was a total of 40 participants randomly separated into two groups. The sample consisted of 10 males and 30 females ranging from the ages of 18 to 27. Each condition group assigned 20 individuals. One participant did not finish the last VAS scale, so that data were discarded for the percent change in VAS measure. 39 participant scores were recorded for that measure.

Participants were informed about all the information about this experiment. It was clearly communicated to all participants that they could stop the survey at any time. All information would be collected anonymously and that all data from the study would be confidential. When they began the survey, all participants gave their consent to participate in the study.

2.2. Materials

Prior to the beginning of the procedure, participants, after their consent, were given a Perceived Stress Scale (PSS) to complete [5]. This is a questionnaire consisting of ten questions all relating to experiences of stress over the past month.

2.3. Procedure

Prior to beginning the study, our group received Institutional Review Board approval secured via an IRB-1C form to the University of Connecticut Review Board.

Using a between-subjects design, students assigned to Condition 1 had an easier digit span task and those in Condition 2 had a more complicated task. Data for all measures was collected through a survey on the Qualtrics platform. Participants were first asked to complete a Perceived Stress Scale survey [5]to estimate levels of pre-existing chronic stress followed by a Visual Analogue Scale [6].

Next, participants were asked to complete 14 trials of a Digit Span working memory task. For each trial, screens containing different number sequences appeared. Participants had one second per number of digits in the sequence. Digits for all trials were selected by a random number generator. Participants in Condition 1 were presented with four trials of three-digit sequences, four trials of four-digit sequences, and six trials of five-digit sequences. Participants in Condition 2 had four trials of six-digit sequences, four trials of seven-digit sequences, and six trials of eight-digit sequences. Each set appeared on the screen for as many seconds as the number of digits.

Upon finishing the task, participants were given a second Visual Analogue Scale to rate the amount of stress they were feeling at that point.

2.4. Results

To examine the results of our study we compared the data collected from our between-subjects independent t-test. The performance from our digit span working memory tasks in two different conditions were indeed different. We compared the total number of correct answers for participants in both Condition 1, the easier task ($N = 20$), and Condition 2, the harder task ($N = 20$). The independent t-test indicated a significant difference between Condition 1 ($M = 13.70$, $SD = .7327$) and Condition 2 ($M = 10.25$, $SD = 3.075$), $t(38) = 4.88$, $p < .001$, $d = 2.24$, indicating that Condition 2 was a harder task to complete.

Additionally, a between-subjects independent t-test was used to determine any significant differences in the change of stress levels between Condition 1 and Condition 2. We hypothesized that the percent change in stress levels for participants would be greater after completing a more difficult working memory task. The stress levels of Condition 1 ($N = 19$) and Condition 2 ($N = 20$) were compared. In line with our initial hypothesis, the results of a one tailed between-subjects independent t-test indicated a significant difference between Condition 1 ($M = -.1357$, $SD = .3923$) and Condition 2 ($M = .2452$, $SD = .7345$), $t(37) = 2.034$, $p < .05$, $d = .59$. This suggests that the harder working memory task elicited greater levels of stress than the easier task.

We then used Pearson's correlation to test several hypotheses for each condition, beginning with Condition 1. First, we tested whether levels of chronic stress correlated with the percent change in current stress indicated by the two VAS scores. Contrary to our initial hypothesis, participants with chronic stress would experience heightened levels of stress, our test did not yield any significant results, $r = -.277$, $p > .05$. Next, we tested whether the total amount of correct answers on the digit span task correlated with either PSS scores or percent change of VAS scores. Though we hypothesized that both would be inversely correlated, e.g. higher levels of either stress scale would yield lower scores on the working memory task, neither PSS scores, $r = -.321$, $p > .05$, nor percent change in VAS scores, $r = -.270$, $p > .05$, were significantly correlated to total number of correct answers.

Our hypotheses for participants in Condition 2 were identical to those of Condition 1 and the results of Pearson's correlation tests within Condition 2 were similarly insignificant. PSS scores had no significant correlation with percent change in VAS scores, $r = -.127$, $p > .05$, and neither PSS scores, $r = .160$, $p > .05$, nor percent change in VAS scores, $r = -.242$, $p > .05$, had a

significant correlation to total number of correct answers on the working memory task.

3. DISCUSSION

How stress impact the test performance is the current main theme of this study. We measured the stress level before and after the digital working memory test, in order to obtain the stress level changes. The total number of students who had increased stress level were added. This fitted our initial hypothesis that students would have their stress level increased after taking WM tests. PSS survey presented that 40 % of participants has PSS scores higher than the average scores before taking WM test; 50% of the participants has PSS scores higher than the average scores after taking WM test. This result showed that test anxiety has always been a relatively common phenomenon in college.

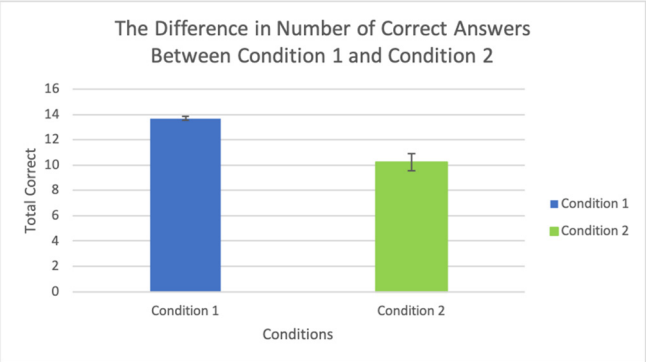

Figure 1. The Difference in Number of Correct Answer Between Condition 1 and Condition2

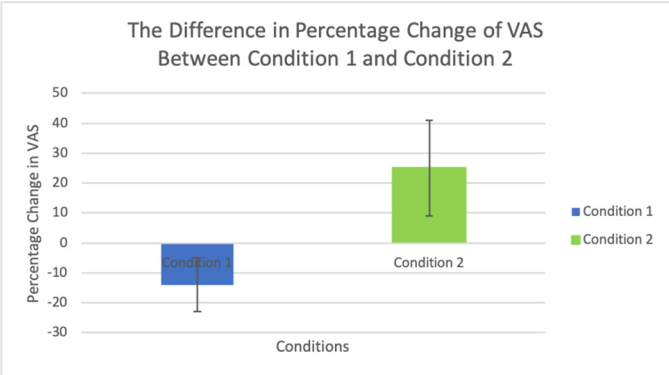

Figure 2. The Difference in Percentage Change of VAS Between Condition 1 and Condition 2

Moreover, we hypothesized that the percent change in stress levels for participants would be greater after completing a more difficult working memory task. According to Figure 1, there is a smaller number of correct answers in condition 2, the harder condition. Besides, the independent t-test analytical statement confirmed the thing that condition 2 has greater percentage of AVS changes compared to condition 1 (Figure 2). It indicated that condition 2 has the harder test to finish for participants. The result showed the consistency with our initial hypothesis. In condition 2, we added more numbers to increase the complexity of the test, which means we added more cognitive load on condition 2, that gave raise to working memory implied defectively. Ray Hembree believed that people who are stressed or anxious will suffer cognitive impairment in the use of working memory when he or she is taking tasks. [7] When the task is relatively simple, although the worry and anxiety of test-anxious people occupy part of the resources, there are still enough cognitive resources to process and process the test task. Thus, the impairment of cognitive function is not obvious. However, when faced with complex tasks, the cognitive resources of the anxious people in the harder exam are occupied by anxiety and stress, which leads to unsatisfied performance. This showed that our conjecture is meaningful. Indeed, more difficult tasks will increase test pressure. At the same time, rapidly increasing test stress can lead to poor grades.

For our second hypothesis, People who have higher anxiety levels will do more poorly than those who have lower anxiety levels. We used Pearson's correlation to test this hypothesis. We used two VAS scores and percentage change in current anxiety levels to verify whether chronic stress levels are corelated with them. The total correct numbers of the WM tests had no clear relationship with neither PSS score changes, nor VAS score changes. It meant that people in different stress status showed no differences when comparing their PSS scores after taking WM tests. Our data shows that participants who experienced stress before the task did not perform worse than those who were not stressed. We failed to suggest that the hypothesis that people who have

higher anxiety levels will do more poorly than those who have lower anxiety levels. This result rejected our initial hypothesis. We ignored that we separated the data by distinguishing two conditions. People who have high stress levels might took different difficulty tasks. This caused the result confused us and let us fail our hypothesis. We lacked internal validity here.

What's more, we assumed that participants with chronic stress would experience heightened levels of stress. However, no significant results yield from our test. Which means we could not sure that participants who had already felt stressed would experience higher level of stress. We assumed that the relationship between total number of correct answers and PSS scores or Percentage change of VAS scores was negative correlation. The result showed not significant findings. We failed to suggest this hypothesis, which indicated that students who suffered high level of stress did not present that he or she would do worse in WM test.

In one study, researchers declared that previous or impending academic performances was not correlated with acute test anxiety, nor any expectations on academic performances, which is similar with our findings [8]. However, their target was more than acute test anxiety, it talked about depressiveness. In our study, our data analysis showed only the correlation between condition and stress. Another possibility that caused we failed to test our initial hypothesis was the impairment of experiment design.

Our experimental design had limitations: We lacked internal validity when we tried to examine our second hypothesis. We could improve our experimental design by increasing our simple size. Larger simple size would decrease the possibility of biases. Besides, we were supposed to spend more time on data analysis. There was external validity that can genialized to other situations.

4. CONCLUSION

In sum, the results of this study show that anxiety has an impact on WM task performance. Stressed students are more likely to have working memory impairment when performing test tasks, which can lead to poor WM task performance.

For our hypothesis: (1) there were increased pressure levels among students after taking WM tests; we failed to prove. (2) Students who have already suffered chronic stress would perform worse than students who did not. The more stressed the participant was, the worse his or her performance would be. (3) Student who took easier working memory test will perform better than student who took harder memory test, based on all the data and analysis we got from experiments.

Based on the view of "Cognitive Load Theory" [9], working memory can be allocated more reasonably and efficiently. Meanwhile, working memory and reading breadth were very closely related to student's comprehension [10]. We could strengthen the training of students' WM so as to improve their reading ability and improve their SAT scores. Therefore, future researches were supposed to conduct training related to cognitive resource allocation for test-stressed people, in order to increase the ability to manage cognitive function and working memory allocation.

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