
**THE EFFECT OF MODERATE TASK-IRRELEVANT,
NEGATIVE EMOTION ON CLASSROOM
TEST TAKING PERFORMANCE IN A NON-CLINICAL
POPULATION**

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Abstract

The present study addresses the role of moderate task-irrelevant negative and positive emotion on verbal memory retrieval during academic testing in the classroom. It is argued that moderate task-irrelevant negative emotion in a non-clinical population is sufficient to hinder memory for academic information, whereas positive task-irrelevant emotion is not affected. Prior to the task, subjects completed a brief questionnaire to determine their emotional status and confidence in taking the upcoming test. A significant interaction was found between intensity of emotion and its valence. Specifically, respondents who expressed moderate levels negative task-irrelevant emotions scored lower during a classroom test than did those who expressed low task-irrelevant negative emotion, whereas no significant difference was found between those who expressed low and moderate positive emotion. It was concluded that those experiencing moderate levels of task-irrelevant negative emotion experienced a distraction of attention. Furthermore, it is suggested that future studies may investigate whether inoculation to performance decrements would occur if a motivating reward is anticipated for test success.

Keywords: academic achievement; anxiety; memory; negative emotion; non-clinical

Introduction

One of the unresolved questions in understanding the relationship between emotion and memory concerns the influence that moderate task

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irrelevant negative emotion has on test-taking performance in non-clinical populations. Although intense negative emotion, such as depression, has been found to affect attention and memory (e.g., MacLeod, Campbell, Rutherford, & Wilson, 2004), less is known about the effects that moderate task irrelevant negative emotion has on memory retrieval in daily activity. However, moderate levels of task irrelevant negative emotion commonly occur during the daily lives of non-clinical populations (Jordan et al., 2011). For example, students often enter the classroom environment to take tests while they are experiencing moderate levels of frustration, distraction, or worry resulting from relationship conflicts, health issues or financial concerns. The intent of the present study was to determine the role of moderate task-irrelevant negative emotion in the retrieval of academic information within non-clinical adult students while they complete a test of academic information.

A large and varied body of research has shown that intense negative, task-relevant emotion often hinders the retrieval of academic information. For example, it has often been shown that test anxiety results in decreased retrieval of well-learned academic information (Cassady & Johnson, 2002; Pekrun, Elliot, & Maier, 2009) as a result of negative self-appraisals that decrease attention available for a test (Parks-Stamm, Gollwitzer, & Oettingen, 2010; Rana & Mahmood, 2010). However, other studies suggest that intensely negative emotions that are not immediately relevant to academic performance may also inhibit the retrieval of well-learned information by decreasing attention given to the task (Vytal, Cornwell, Letkiewicz, Arkin, & Grillon, 2013). Evidence of this deleterious effect has also been found in clinical studies which report that long-term negative emotions such as depression (e.g., Thomas et al., 2009) and post-traumatic stress (e.g., Goodman, Leong & Packard, 2012) hinder memory retrieval. While persistent decrements in memory have been found to occur during intense, long-term negative emotion, similar effects may also occur during moderate, short-term, negative emotions. For example, it has been found that moderate negative mood that is induced in the lab can hinder the recall of recently learned words (Ellis, Thomas, McFarland, & Lane, 1985). Moreover, other lines of research have found that diffuse psychosocial stress inhibits the retrieval of verbal memory (e.g., Kuhlmann, Piel, & Wolfe, 2005; Merz, Wolf, & Hennig, 2010; Schwabe, Wolf, & Oitzl, 2010; Smeets, 2011). These findings are consistent with test anxiety evidence that finds that significant negative emotion inhibits memory retrieval

(e.g., Ashcraft & Kirk, 2001). Thus, moderate irrelevant negative emotion may also be able to hinder the retrieval of well-learned academic information from long term memory. Although positive emotion has been found to enhance many cognitive functions by broadening attention (Fredrickson & Branigan, 2005; Rowe, Hirsh, & Anderson, 2007) and enhancing the retrieval of emotionally related positive memories (Ritchey, LaBar, & Cabeza, 2011), the need to focus attention for memory retrieval may reduce its effectiveness in memory retrieval.

Objectives

In the present study it was anticipated that an interaction would occur between task irrelevant emotional valence (negative vs. positive) and emotional intensity (low vs. moderate) in the retrieval previously studied information during the completion of a test of academic information that has been previously. Specifically, it is argued that test-irrelevant, negative emotion will inhibit the retrieval of academic information during a classroom exam only if it is of moderate intensity, whereas positive emotion will not affect retrieval regardless of its intensity.

Method

Participants

One hundred twenty-nine college students including 89 females ($M=21.84$, $SD=4.29$) and 40 males ($M=20.93$, $SD=2.09$) served as participants and received credit for undergraduate college courses, and students were given alternative sources for credit if they opted out of the study. Anonymity was produced by coded numbers that removed any identification of participants. The study was approved by the internal college review procedure.

Measures

Measure of Emotional Intensity. One question in the survey asked the participants how relaxed they were. The response was scored using a six-point Likert scale in which 1=Very Relaxed and 6=Very Unrelaxed. A median split was conducted on the distribution. Those reporting a score of 3 or higher were

coded as Moderate Intensity, whereas those scoring below 3.0 were coded as Low Intensity.

Measure of Emotional Valence. Emotional state was determined by a question asking respondents to circle the mood that best described their emotions at the beginning of the test. The emotional valence question was separated by three distractor question to minimize a carry-over effect. Only two emotion choices were provided: Negative or Positive.

Association between Test Confidence and Emotion. Respondents were asked how confident they were concerning their potential success at the upcoming test. The response was scored using a six-point Likert scale where 1=Very Unconfident and 6=Very Confident. Pearson correlations were conducted between confidence level and arousal $r(128)=-.11$, and between confidence and performance $r(128)=.06$, showed no significant associations. These measures served as checks on the relevance of emotional valence and intensity on performance, and suggested no significance association between emotion and performance.

Design

A 2x2 factorial model that included emotional valence (positive vs. negative) and arousal intensity (low vs. moderate) was presented in which the amount of self-reported study time for the exam (in hours) served as a covariate to isolate emotion valence and intensity. The dependent variable was the score on a multiple choice test of 100 points that was converted to standardized z scores to normalize the distribution and insure equality between groups. Thus, a score of zero served as the grand mean. Thus, negative scores indicated scores below mean performance, and positive scores indicated scores about the mean. An estimation of sample size, given a power of .80 and effect size of .40, suggested that approximately 32 cases per cell would be required.

Procedure

Students were given three weeks to prepare in traditional introductory college class that included 12 hours of lecture and three chapters of textbook material. On the date of the test students met in their classrooms at their traditionally scheduled meeting times. The classes consisted of groups between 25 and 30 students. Once they were seated they were informed that they would be given the opportunity to participate in the study for extra credit. After a brief

introduction the students completed required forms and any questions were addressed. Then they were asked to complete a short one-page closed-ended survey that consisted of 12 questions. This consisted of a number of demographic questions that served as distractors, such as college major, sex, handedness, and perceived level of extroversion. The questions of interests included the amount of time they spent studying (in hours), as well as their emotional state (positive or negative) and the intensity of their level of feelings at test time. After completion of the survey, each student was given an hour to complete the test and received a debriefing via written description of the study after completing the test. Any additional questions were answered and contact information was given prior to their released.

Presentation and interpretation of the results

A two-way analysis of covariance was conducted on standardized z scores of student performance on a multiple choice test. In support of the hypothesis, a significant interaction was found between valence and intensity of test irrelevant emotion, $F(1, 124)=10.03, p<.002$. Specifically, it was found that those experiencing moderate intensity irrelevant negative scored lower on a multiple choice test than those expressing low intensity irrelevant negative emotion, while or no differences between positive task irrelevant emotion regardless of intensity. In order to identify specific mean differences, pairwise comparisons of group means were conducted. It was found that those who expressed low intensity negative ($M=0.218$) emotion, had a mean accuracy of retrieval that that was significantly greater than those who expressed a moderate intensity ($M=-0.469$) task irrelevant negative emotion, $t(60)=10.05, p<.005$. However, no significant differences in accuracy were found between low intensity ($M=0.161$) and moderate intensity ($M=0.253$) positive task irrelevant emotion, $t(84)=.255, ns$.

A significant main effect for performance accuracy found that those expressing positive emotions ($M=0.200$) were more accurate than those expressing negative ($M=-0.070$) emotions ($F(1, 124)=6.71, p<.01$). However, this was largely due to significant differences in retrieval accuracy in which those expressing moderate negative emotions ($M=-0.469$) were less accurate than those expressing positive ($M=0.253$) emotions, $t(53)=3.804, p<.001$. In addition, a significant main effect on performance accuracy was found due

between low ($M=0.180$) and moderate ($M=0.016$) intensity emotions, $F(1, 124)=4.93$, $p<.03$. Finally, to control for study time prior to the tests, no covariate effect was found between the amount of self-reported study time and accuracy of performance ($F(1, 124)=0.68$, ns), suggesting that the effects of emotion were independent of study time prior to the test.

Conclusions

The present study found support for the hypothesis that normally functioning students may underperform academically, regardless of their academic preparation, if they are experiencing moderately negative emotions that are unrelated to the academic task at hand. This finding is consistent with studies that have found decreased academic performance when experiencing test anxiety (e.g., Rana & Mahmood, 2010). However, the present study extends these findings to moderate irrelevant negative emotions that are not associated with the test that is being taken. This risk factor is more likely to go undetected than intense negative emotions that are often severe enough to warrant a clinical intervention. Finally, no significant effects in performance were found while experiencing moderate positive emotion.

One potential explanation for the decrements in performance while experiencing negative emotions is that available attention capacity in working memory is divided (Cowan, 2006) between the cognitive task and the emotion, and this decreases available attention for memory retrieval (Beilock & Carr, 2005). This pattern is consistent with evidence that working memory attention shifts from test taking behavior when test anxiety is present (Vytal et al., 2013). The result is a more significant decrement in memory because its threatening message refocuses attention to emotion related cognitions (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007; Eastwood, Smilek, & Merikle, 2001). Previous research has shown that positive emotion broadens attention (e.g., Rowe, Hirsh, & Anderson, 2007) and this fails to focus attention which needed for memory retrieval. Thus, no enhancement in performance would be anticipated. For example, it has been found that negative autobiographical memories focus attention on central features of an event more than do positive autobiographical memories (Talarico, Berntsen, & Rubin, 2009).

One limitation in the present study was the lack of a measure to determine if information had been encoded in long-term memory prior to the test. However, self-reported study time prior to the test was used in an attempt to control for this effect which showed no clear associations between hours spent and overall performance. In addition, future evaluations of emotion and test performance should attempt to control for individual differences in both emotional response and arousal. For example, gender differences in emotional functioning have often been reported (Whittle, Yücel, Yapa, & Allen, 2011). An additional question for future investigation concerns whether reward expectancy may serve to inoculate individuals from experiencing the harmful effects of transitory task-irrelevant negative events. Specifically, it has been argued that reward expectancy motivation may interact with emotion to encourage a re-allocation of attention to rewarded tasks (Pessoa, 2009). A recent study has shown that reward for cognitive behavior enhances visual processing and reduces the effect of threatening shock (Hu, Padmala, & Pessoa, 2013). Given this situation, extrinsic reward may increase academic performance even when task-irrelevant negative emotion is present.

In conclusion, the findings in the present study suggest that even relatively moderate levels of negative emotion which is unrelated to a cognitive task can hinder the retrieval of long term memory. Persistent levels of moderate negative emotion could result in serious consequences for academic success. While positive emotion has not been found to improve the retrieval of unrelated academic information, its presence may insulate memory from decrements in academic performance. Furthermore, it can be predicted that any number of unrelated personal, social, medical, or economic problems may produce similar moderate levels of detrimental negative emotions that will harm academic success. Thus, a student experiencing moderate distress may significantly underachieve in class despite superior preparation or ability.

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