STUDENT INSPIRATIONAL POSTING AS A LOW-STAKES INTERVENTION TO REDUCE TEST-ANXIETY

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ABSTRACT

Test-anxiety is a common issue in education often connected with academic underachievement. This study attempted to alleviate test-anxiety through student-written inspirational messages projected on the classroom wall during the final exam. We recorded test-anxiety scores from 226 higher-education students before the exam and assessed the effects of the intervention thorough a post-exam survey. Most students in the study reported positive feedback from the experience. Students with high level of anxiety self-reported a statistically significant reduction of test-anxiety when compared to peers with low or medium levels of test-anxiety ($p<0.05$ and Cohen's $d=0.47$).

Keywords: test-anxiety, student-driven intervention, student attitudes

INTRODUCTION

Test-anxiety is a psychological condition often connected to academic underachievement (Dawood et al., 2016; Nunez-Pena at el., 2013; von der Embse et al., 2018) and college dropout rates (Dodd, 2007; Trifoni, & Shahini, 2011). Although test anxiety reaches across disciplines, increased rates of test-anxiety have been reported among test-centered disciplines such as science (Mallow, 2006; McCarthy& Widanski, 2009), math (Beilock, 2010; Foley, et al. 2017; Furner & Gonzalez-DeHass, 2011), and nursing (Dawood et al., 2016).

Test-anxiety in the psychological literature was outlined more than 50 years ago by Sarason and Mandler (1952). During the initial periods of inquiry, Zeidner (1998) demarcated the "test-anxiety" construct to include emotions such as fear of failure and/or negative judgments (a cognitive component), physical tension (an affective component), and/or procrastination (a behavioral component). Zeidner (2014) later broadened the construct to encompass recall challenges with testing material and potential test-associated symptoms such as sweating, nausea, tightening of muscles, heart palpitations, muscle tension, mind-freeze, concentration challenges, emotional agitation, and fear of failure. Text-anxiety has been further demarcated as a situation-specific phenomenon that produces a series of emotional, physical, and physiological symptoms in response to a perceived evaluation threat, either before or during a text (Elyas & Rehman, 2018; Sommer & Arendasy, 2015).

Ample research highlights the mental, emotional, and behavioural aspects of test anxiety. For instance, positive correlations exist between test-anxiety and impaired concentration (Eysenck et al., 2007) and procrastination (Custer, 2016; Grunschel et al., 2013). These traits have important consequences for academic (and life) success. Ashcraft (2007) explains that anxiety lowers test performance due to the dysfunctional thoughts interfering with working memory and impeding concentration. In addition to memory and other cognitive challenges, academic under-performance in the face of a perceivably threatening exam can influence emotional state or mood (Bellinger et al., 2015). Similarly, Dodd (2007) pointed out that testing can elicit feelings of fear, especially when the test results may be the difference between passing to the next grade level and/or graduating.

Von der Embse and colleagues' (2018) 30-year

meta-analytic review revealed that low self-esteem and perceived level of difficulty were significant and strong predictors of test-anxiety. Students with high levels of perfectionism tend to suffer more (Abdollahi, et al., 2016). Such test-anxiety is prevalent among nursing students (Poorman et al., 2019). Test-anxiety can be intensified by mental health issues such as depression (Dyrbye et al., 2016) and social anxiety (Brook & Willoughby, 2015). Steinmayr et al. (2016) found that the "worry" element of test-anxiety had a fairly predictive relationship with the "life satisfaction" component of subjective well-being. In other words, those who consistently worry about test taking are less likely to feel positively about themselves.

In contrast, students exhibiting low levels of test-anxiety tend to be more optimistic (Çikrıkci et al., 2018) and display high levels of "academic hardiness" (Abdollahi et al., 2016). Putwain et al. (2015) highlighted the difference between test "worry" and test "tension," revealing test worry tends to produce a negative feedback loop that decreases academic hardiness and test scores. Perception of the testing process influences test-anxiety and has been a focus of various interventions for students in higher-education, including the present one.

CURRENT INTERVENTIONS

Several test-anxiety reduction methods have been documented. Lothes and colleagues (2019) examined the effects of Dialectical Behavior Therapy (DBT) on college students in relationship to test taking. Not only did the DBT mindful course help students reduce their test-anxiety, but it also increased their overall reported levels of mindfulness that extended beyond the course. Students assigned to biofeedback relaxation training had decreased levels of anxiety and improved academic performance, as compared to the control group (Aritzeta et al., 2017). Students assigned to the attention training technique (ATT) intervention reported significantly less test-anxiety than the control group, particularly within the cognitive/worry dimension (Fergus & Limbers, 2018). Despite their promising impact, many of these interventions are time consuming and require clinical implementation and supervision outside of the classroom.

Less structured anxiety-reducing methods that focus on cultivating positive emotions have, historically, showed promising outcomes within academia. For instance, researchers found that playing background music prior to test-taking moderately decreased test-anxiety (Hirokawa & Ohira, 2003; Labbé et al., 2007; Sezer, 2009) and greatly improved levels of concentration and mental focus (Mori et al., 2014). Other methods that mediate the effects of test-anxiety include journaling (Stogsdill, 2013), short expressive writing activities (Park et al., 2014), and longer, positively focused expressive writing activities (Shen et al., 2018). Ramirez and Beilock (2011) revealed that students who wrote about their test fears prior to taking the exam performed better on the exam. This was mainly true for habitually anxious students. The researchers concluded that the simple act of acknowledging these feelings served as a distractor and mediator of negative emotions. In a similar study, Nelson and Knight (2010) reported how students felt less stressed and more empowered to take their exam after having reflected on positive personal experiences. Those assigned to the mood enhancing intervention also had higher test grades. Arens et al., (2017) maintain that identifying resources and interventions for decreasing test-anxiety should be a priority for the academic community. It is no wonder these interventions were effective, as positive emotions such as joy, contentment, and amusement are found to help people to recover more quickly from negative emotions, such as anxiety (Fredrickson et al., 2008). Positivity has a way of "undoing" some of anxiety's negative symptoms and broadening intellectual resources. This result supports the control-value theory of achievement emotions (Pekrun, 2006), which attributes test-anxiety to one's appraisal of the testing situation and anticipated outcome. In other words, feeling tense before a test is relatively natural and does not impede performance.

The current study investigated the effects of a student-driven classroom intervention on test-anxiety and related test performance. Specifically, we asked students to anonymously share an inspirational or spiritually significant quote/message that was displayed on the classroom screen during the final exam.

MATERIALS & METHODS

Population

The subjects for this study came from undergraduate students enrolled in both psychology and math courses at a four-year, private university located in the Southwestern United States. This study received Institutional Review Board (IRB) approval. There were no recruitment efforts. Students enrolled in the courses based on their personal needs and were unaware of the study at time of enrolment.

Data Collection & Instruments

The data for the study were collected in the classroom over three different meetings and using three different instruments: Test-Anxiety Questionnaire (TAQ), inspirational posting, and Post-Exam Survey (PES).

The TAQ was administered the week preceding the final exam. Developed in 1990 by Sherrie Nist and William Diehl, the TAQ was intended to assess students' level of test-taking anxiety. The short questionnaire contains 10 items and uses a five-point Likert-type scale to estimate the severity of test-anxiety. Physical (e.g., upset stomach), mental (e.g., inability to concentrate), emotional (e.g., irritability), and behavioral (e.g., quick temperedness) symptoms are assessed (Nist & Diehl, 1990). The TAQ has been used with high reliability in similar studies (Abd el-Aziz et al., 2012; Abed, 2016; Bahmani-Fard, 2013). Students' TAQ scores vary between 10 and 50. Scores between 10 and 19 indicate a low level of text-anxiety. Scores between 20 and 35 indicate some level of stress anxiety. Scores above 35 indicate a high level of test-anxiety (Nist & Diehl, 1990).

During the week preceding the final exam, students were given the task of posting an inspirational or spiritually significant message or quote via PollEverywhere (2019) technology. PollEverywhere is a web 2.0 tool that utilizes the Internet and/or text messaging to collect and track responses in real time. It is a subscription-based software provided to the employees and student body of the institution in which this study took place. With PollEverywhere the anonymous responses were displayed as a loop on the overhead screen while students worked on their exam.

After completing their final exams, students were asked to complete a post-exam survey (PES). The PES consisted of five paper and pencil questions, as well as an opportunity to consent or opt-out of the study. Students rated the benefits of the pre-test activity using 5-point Likert-type questions. In addition, qualitative data was solicited to assess whether students felt more empowered, confident, or experienced other feelings after reading the inspirational posts. The full PES is included with the Supplemental Information (SI). The university learning management system provided other data such as demographics and course outcomes.

Data Analysis

All subjects in the study were assigned a unique code to mask their identity. We collected 226 TAQ scores and 249 PES. This difference is due to students missing class on the day the TAQ was administered, but still completing the course by taking the final exam. The raw data were then organized into quantitative and a qualitative dataset for analysis.

Quantitative Analysis

TAQ scores across courses and across disciplines were compared. A correlation analysis between TAQ and PES scores was performed for all students who had both a TAQ score and a final exam score (n=226).

The statistical comparison of TAQ scores led us to focus our analysis on four groups, the overall population, and the three levels identified by Nist and Diehl (1990), and based on the TAQ score: "Low" (10-19), "Some" (20-35), "High" (35+). We calculated the univariate descriptive statistics of TAQ scores, test scores, and the questions in the PES with a 5-point Likert-type scale across all four groups.

To analyze the connection between the TAQ and the free responses in the PES, we combined the students with "Low" and "Some" score into one group (n=124). We compared this group PES answers with the ones from the 32 students with "High" TAQ score. This analysis includes null hypothesis testing, effect sizes, and confidence intervals (American Psychological Association, 2019). Effect sizes were calculated using Cohen's d formula (Cumming, 2013).

Qualitative Analysis

The last question in the PES is an open-ended request for additional feedback on the intervention and its effects. Two investigators independently

coded responses to identify emerging themes. To reduce investigator bias, the coding was done in collaboration with three local senior and graduate psychology students with experience in research. Each student coded a set of questionnaires, and afterward the emerging themes were discussed as a group. During the coding analysis, we also grouped the themes into three main categories: positive, neutral, and negative.

RESULTS

Quantitative Results

Across the four courses, almost one in five (18.2%, n=41) of the 226 students who took the TAQ experienced a high level of test-anxiety. The Pre-Calculus course had the highest percentage (28.2%, n=11) of students with high anxiety (see SI for a breakdown of the population in the dataset). There was a weak negative correlation between TAQ scores and final exam results with a coefficient of determination (R^2) below 0.1.

We hypothesized that displaying inspirational quotes during the exam would have positive effects with respect to test-anxiety. To quantify this hypothesis, we analyzed the three 5-point Likert-type questions in the PES. The overall count distribution for the three questions is shown in Figure 1. A quarter (26%, n=64) of the students reported that the posting activity reduced their anxiety level. Nearly half (46%, n=114) of the students reported that posting something inspirational was a valuable pre-exam activity to reduce anxiety, while 4% (n=10) indicated a negative opinion about it. Similarly, 45% of students (n=112) reported that the posts made them feel more confident during the exam, compared to 10% (n=24) who disagreed with this statement.

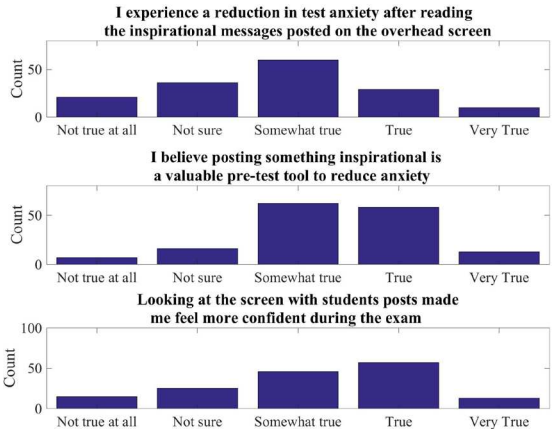

Figure 1. Quantitative results for the three Likert-type questions in the post-exam survey. The horizontal axis shows the label of the answers. The vertical axis shows the number of responses corresponding to the Likert label.

To further investigate these results, we aggregated the answers from students with "Low" and "Some" TAQ scores into one group that we labelled "Weak." We compared this aggregated data to the group with "High" TAQ scores. We ran an analysis of mean differences between the two groups to compare the effects on test-anxiety (column 2 in Table 1), posting something inspirational before the test (column 3 in Table 1), and reading something inspirational during the test (column 4 in Table 1). The second column in Table 1 shows a p-value less than 0.05, suggesting that the difference in outcomes between students in "High" and "Weak" groups is statistically significant at the 95% level. The effect size (measured as Cohen's d) of 0.4748 is associated with a Medium effect (Cumming, 2013). The last two rows of Table 1 show the higher and lower bound of the 95% confidence interval for each question. For the first question, these values show that we have 95% confidence that there is a positive difference of the mean between the two groups. There is no statistically significant difference for the other two Likert-type questions in the PES due to high p-values, small effect sizes, and the presence of zero within the boundaries of the confidence intervals.

Qualitative Results

A majority of the students (65%, n=162) provided a qualitative post-activity response regarding the impact of the inspirational posting intervention (Table 2). Seventy-eight percent (n=126) of the responses that we coded as positive, and only 8.6% (n=14) of the subjects provided responses that we coded as negative. Nine emerging themes from these responses were further identified. Twenty-six percent (n=42) of students reported feeling of calm, reduction of stress, or relaxation in response to the displayed quotes. Exemplary responses illustrating this theme included: "I was stuck on a question and I started to get nervous; when I looked at the screen, I felt calmer due to the encouraging words," "I walked in feeling anxious. Looking at the screen reminded me to breathe and feel at peace," and "Reading the posts helped me take a step back and relax, less tense."

General enjoyment of the inspirational posted quotes was noted by 14% (n=23) of the students.

Specifically, one student wrote, "The act of posting something was very beneficial, even if reading other posts wasn't." Four students wrote that they enjoyed the student-driven nature of it. One student claimed, "I liked it because it wasn't just a professor choosing a quote, but it was ones chosen by us, the students."

Some students (17%, n=28) reported feeling more positive and/or experiencing an improvement in general well-being after participating in the activity. Some responses highlighting this theme were: "It definitely brings a positive light to test taking," and "This was a fun and refreshing exercise; this felt good!" Some students reported increased levels of confidence. One student wrote, "I felt better capable to handle the task."

Seventeen students (10%) reported feelings of inspiration: "I felt inspired by posting; I was giving from my heart," "I enjoyed posting something that could uplift my peers." Some students suggested that professors should begin employing this activity in their classes and reported included mixed benefits of motivation and relaxation.

Another theme that emerged was that posting and reading inspirational statements made students feel less isolated and/or part of a community (5%, n=8). Some responses highlighting this theme were, "The quotes were helpful because they reminded me that I was not alone and that everyone was taking the test," and "I was happy to see that everyone supported one another even through very stressful times in our lives."

Humor was another positive theme that emerged in this study, as reported by 5.6% (n=9) who noted benefits from reading the comedic posts. Not surprisingly, those who appreciate the humor also indicated improvements in psychological well-being and reduced stress levels. One student wrote, "It made me internally laugh. I feel like humor calms my nerves."

While the responses were overwhelmingly positive, six (4%) students claimed feeling distracted by the inspirational postings. However, four of these six students also reported some positive benefits. One student wrote, "I got more distracted by them, but it was a nice little mental break." It is important to note that those distracted by the activity were all math students.

DISCUSSION

Results show that test-anxiety is present across disciplines, and that it can be addressed in a meaningful way through student-driven inspirational posts. The study highlights the different emotional outcomes elicited by the inspirational postings. These outcomes are mostly (78%, n=126) positive.

The TAQ scores showed that test-anxiety is an issue that affects one in five students (SI). The negative correlation between TAQ and exam scores may mean that high TAQ are more likely to correspond to lesser exam scores than low TAQ. However, a small coefficient of determination (less than 0.1) implies that TAQ scores can explain less than 10% of the variability of exam scores (SI). These results suggest that college students can overcome academic performance issues connected to test-anxiety.

Responses to the Likert-type questions show results mostly centered around the "Somewhat True" answer, suggesting that it may not be possible to make a meaningful inference from this data (Figure 1). This is to be expected since the majority of students has some or no test-anxiety. For the second and third questions, the mean comparison analysis outputs high p-values, small effect sizes, and zero value within the 95% confidence intervals. A zero value inside the confidence interval implies that there is a strong possibility that the mean values for the two groups are the same. These results suggest that "High" and "Weak" test-anxiety students are likely to report the same reaction to the process of writing inspirational posts and reading them during the exam.

The same analysis of students' PES responses revealed a statistically significant effect with respect to the self-reporting of a reduction in test-anxiety. This result supports the conclusion that the posting intervention is more beneficial to students with "High" test-anxiety (Table 1).

The present study showed that the posting activity was a simple, but effective mindful intervention that reduced stress through emotion regulation. Results support previous findings that even brief mindful interventions can significantly mitigate test-anxiety (Shahidi et al., 2017). Inspiration posts served as a stress buffer, primarily among students with high anxiety scores for whom there was a self-reported statistically significant

reduction of anxiety. Psychologists agree that improved feelings of subjective well-being are associated with lower levels of anxiety and vice versa (e.g., Beiter et al., 2015), which was reflected in most of the emergent qualitative data.

The role of inspiration, which emerged as a theme in this study, is often ignored or overlooked in academic setting due to its elusive nature. Inspiration is a valuable psychological construct that rouses new possibilities by permitting one to rise above one's ordinary experiences and confines, as noted in Thrash and Elliot's (2003) research. Heightened awareness and clarity are important elements to the test-taking process. Considering the apathetic disposition of some test takers, a better understanding of inspiration and its impact on test taking is recommended for research inquiry.

A somewhat surprising theme that emerged was that posting and reading inspirational statements helped students feel less isolated and/or part of a community.

These results reinforce recent findings (e.g., Hoferichter et al., 2014; Kavanagh et al., 2017) that being socially connected with peers can mitigate the effects of stressful situations, such as test taking. This feeling of disconnection and isolation during the test taking has received little attention in the literature. However, the emotional benefits of affiliative behavior and obtaining social support when faced with stress is well documented. Faircloth (2009) asserts that interacting through sharing views and listening to other perspectives is a way to give students ownership of their academics and central to the community building process. Students are continually searching for ways to belong and identify with others, which is why educators might consider implementing tasks that harness such activities (Faircloth, 2009). The sense of belonging in the classroom has a profound impact in academic achievement, especially for under-represented students (Booker, 2016), and warrants a deeper exploration.

Many students reported feeling reassured after reading the postings. Confidence in test taking is extremely important since it translates to perception of ability. Related to working memory, those who have a positive perception of their ability tend to be more accurate with task completion and less likely to shut down (Bleilock, 2011). These findings support the use of brief confidence boosting interventions prior to test taking. Humor may be one viable intervention, as revealed in many student responses and found to be an effective coping mechanism for anxiety (Kugler & Kuhbandner, 2015; Tagalidou et al., 2019), oftentimes improving test performance (Berk & Nanda, 2006).

Students clearly benefited from the prosocial nature of the intervention. Results line up with Raposa et al. (2016) findings that engaging in, versus receiving, prosocial behaviors activate several psychological and biological pathways, serving as a strong "buffer" for anxiety. Based on the student feedback, the act of posting appears to have strengthened interpersonal resilience among many of the students. Hartley (2011) revealed interpersonal resilience was significantly correlated with academic persistence and overall mental health. The significant demands of college life warrant more classroom interventions to increase resilience, especially during stressful times like testing.

We initially speculated that reading other students' inspirational posts would underpin reported benefits. While this was the case for many, post-activity responses revealed that the act of posting contributed to higher levels of well-being for several students. In fact, the act of posting was a common drive behind the "inspired" comments, as opposed to feeling inspired by viewing other students' posts. Future research might compare the perceived value of posting something inspirational versus reading something inspirational, exploring the unique interconnection between the two activities.

Many of the emergent positive themes were interconnected (e.g., enjoyment and feeling more positive), yet it is challenging to pin-point specific reasons behind them since several students did not explicitly specify why the activity was beneficial in their open-ended post reflection. For instance, students who reported an appreciation for being given the opportunity to uplift others might have also felt inspired, more confident, more connected as a community, more positive, less anxious, or some of the above.

A few limitations must be noted. Some students were unable to participate in the activity due to seat location. The Likert-type questions had two choices, "Not Sure" and "Somewhat True," that could have been separated into more distinct categories such as "Not true" and "Neutral." The small font size was a challenge for three students.

Future interventions using larger font is suggested so students in the back rows or those with poor vision can benefit from the posting experience. It would also be beneficial to compare the length of time posts are left on the screen, possibility omitting them during part of the testing period or reminding students to avoid viewing them if they are easily distracted.

RECOMMENDATIONS

Results of this study unveiled a strong appreciation for the student-driven nature of the activity. Current best pedagogical practices of active, inquiry-based learning are now aiming to optimize student engagement via student-driven models (Buchanan et al., 2016). More test-anxiety buffers like ours that encourage (versus demand) student engagement and ownership without disrupting the testing environment are needed. Institutions might afford students more mediums to actively participate, as it provides them with an element of perceived control and ownership during a stressful time. Future studies might investigate the role of perceived control and ownership in the context of test taking.

Our exploration adds to the evidence supporting the adoption of more mindful-based and holistic interventions into the classroom during this stressful and isolating time for many. Regular utilization of the posting activity is realistic since it is student generated and places minimal time demands on instructors. Implementing evidence-based methods that decrease anxiety for students should remain a priority for educational institutions whose mission centers on academic excellence, community building, and supporting a smooth educational journey.

Tables

Table 1: Statistical Analysis of the 5-point Likert-type Questions in the Post-Exam Survey (PES)

For this analysis we divided the population into two groups. One group, labeled "Weak" consists of all subjects who scored between 10 and 35 in the TAQ and represents students with low or some level test-anxiety. The other group, labeled "High," consists of all subjects with TAQ scores above 35 and represents students with high levels of test-anxiety. For each group we show mean and standard error of the mean (SEM). The last 5 rows show the quantitative comparison of the means between the two groups via p-value, effect size, and confidence intervals.

	I experience a reduction in test anxiety after reading the inspirational messages posted on the overhead screen	I believe posting something inspirational is a valuable pre-test tool to reduce anxiety	Looking at the screen with students posts made me feel more confident during the exam
Mean_High ± SEM (n=32)	3.2188 ± 0.1995	3.4375 ± 0.1676	3.21875 ± 0.1781
Mean_Weak ± SEM (n=124)	2.7097 ± 0.0950	3.3226 ± 0.0838	3.1694 ± 0.1016
Mean Difference	0.5091	0.1149	0.0494
P-value	0.0178	0.5368	0.8223
EffectSize	0.4748	0.1227	0.0446
CI_Max	0.9421	0.4822	0.4513
CI_Min	0.0761	-0.2524	-0.3525

Table 2. Results from the Qualitative Analysis of the Open-Ended Question in the Post-Exam Survey (PES)

Answers were coded for emerging themes and ideas. We categorized each of them as Positive, Neutral, or Negative, and we grouped similar ideas into one emerging theme.

Category	Frequency	Percent (N=162)	Emerging Theme
Positive	42	25.90%	Calmed/Reduced Stress/Relax
Positive	17	10.50%	Inspiring/Uplifting/Motivating/Encouraging
Positive	8	4.90%	Less isolated/Part of a community
Positive	9	5.60%	Humour
Positive	23	14.20%	Enjoyed the activity/Opportunity to Uplift Others
Positive	28	17.30%	Positivity/Confidence/Improved my well being
Neutral	21	13.00%	Unsure of the effect
Negative	6	3.70%	Distracting
Negative	8	4.90%	Couldn't see/Hard to see

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