

Effects of Deep Breathing and Muscle Relaxation on ACT Scores

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Abstract

This study examined the relationship between perceived test anxiety and ACT scores. Participants included 58 high-school students (21 males, 37 females), preparing for the ACT's. The experimental group received relaxation and deep breathing training to help manage their test anxiety. Results showed that while no significant differences were found among ACT scores between the experimental and control groups: post-test scores on an anxiety scale did reveal a significant difference. Implications of findings are discussed.

In accordance with the DSM-IV-TR, under the American Psychological Association (American Psychiatric Association, 2000), extreme levels of test anxiety meet criteria for axis I, generalized anxiety disorder (Bögels, Alden, Beidel, Clark, Pine, Stein & Voncken, 2010). It is important to understand that test anxiety is a situation-specific anxiety that occurs only when performance is being evaluated (Putwain, 2008). Students may not suffer from anxiety in other aspects of their lives, but when asked to complete an examination, they may begin to experience the cognitive, emotional, and physiological components of anxiety (2008).

As a personality trait, test anxiety can be seen as the situation-specific trait in which a student finds testing to be threatening (Spielberger, & Vagg, 1995; Putwain, Connors, & Symes, 2010). Anxiety, as a personality trait, has been linked to maladaptive perfectionism (Rice, Leever, Christopher, & Porter, 2006), where the greater the pressure placed on the student to do well on a given test, the more anxious the student would become (Mulvenon, Stegman, & Ritter, 2005). Students with personality trait anxiety will seek to gain approval through their test scores from either parents or teachers, while simultaneously feeling that regardless of their scores they will never meet those expectations (Rice et al, 2006). Anxiety occurs pre- and post-test because students think that their abilities to retain and remember information will fall short of their own expectations and of their instructors (2005).

Test anxiety as an emotional state is exhibited among students that do not normally experience test anxiety as it does not include underlying pathology and yet under certain circumstances these students can still experience test anxiety. These circumstances are test specific and include negative self-belief about performance on a test which may be linked to poor study habits, an emotional anomaly during the course of study for that specific test, and avoidant behaviors for the test (Putwain, 2008). Students who do not commonly have test anxiety may experience it if they do not feel prepared for the test.

The ACT

The American College Testing (ACT) organization was founded in 1959 and created the ACT to aid students in narrowing what college to attend and has also created an admission standard for colleges (ACT, 2010). There are four components to the ACT: English, math, reading, and science, which all comprise a total of 215 questions. Furthermore, there is the option of an additional writing exam (ACT, 2010). The ACT test has been administered in all fifty states since 1960. There are twenty-seven states where at least 50% of high school students take the ACT test. Subject matter on the test is based on curriculum mandated to high schools rather than IQ or aptitudes like many other standardized tests (ACT, 2010).

The implications and assertions that are made based on the scores of ACT's, can have fruitful and negative outcomes for those who take it, especially when scores are not accurately representative of the student's actual cognitive abilities. In fact, one study that examined test anxiety specifically, in relation to ACT scores, found that test anxiety and self-concept, uniformly affected academic achievement (Williams, 1992). Lee (1995) concluded that test anxiety affected memory processing in terms of speed and accuracy of declarative memory. The results of the aforementioned study depicted the conflict associated with timed high-stakes testing, such as the ACT and the in-ability to recall information. More and more studies

conclude a basic premise that test anxiety is significant and impactful on true test scores and can likely influence the outcome (Bradley, McCraty, Atkinson, Tomasino, Daugherty, & Arguelles, 2010; Everson Smodlaka & Tobias, 1994; Putwain, 2008; Swayer & Hollis-Sawyer, 2005). Cognitive abilities tests aim to measure students' performance as well as tapping into anxiety-influenced responses (Selkirk, Bouchev and Eccles, 2011).

Gender and Testing

The conflict between accurate representation of gender differences among achievement and testing can also be noted with regard to test anxiety. Some studies have revealed that gender, specifically females, is more likely to serve as predictors for test anxiety than males (Putwain, 2007; Selkirk, Bouchev and Eccles, 2011). On the other hand, other studies report that gender does not serve as a predictor for test anxiety. For example, Onyeizugbo (2010) conducted a study that found that gender was not a significant predictor for test anxiety, and attributes this to the current trends in society. In other words, expectations regarding gender roles, although different; are in fact changing. Those students currently in the college setting, as in the previous study are expected to excel regardless of their gender. This still doesn't account for the studies within the last five years, proposing the opposite.

Gender differences concerning measures that test an individual's cognitive abilities are evident in the 21st century. Indeed, differences in achievement and learning abilities have been studied for nearly a hundred years (Thorndike, 1914; Roberts & Bell, 2000; Sekine, Chandola, Martikainen, Marmot & Kagamimori, 2010). Males have had consistent classroom advantages regarding specific attention paid to their academic achievement and retention of information. On the other hand, females have not had the same kind of treatment as their male counterparts (Wellesley College, 1992). Not all research supports this type of assertion. In recent years, studies have shown where males once outperformed females, are now noting a shift where females are outperforming males in most areas of education (Marks, 2008; Van de Gaer, Pustjens, Van Damme & De Munter, 2009).

In terms of testing, the National ACT Score Report of 2010 showed that females still scored the same or lower than males on their composite scores as in previous years (2009, 2008, 2007, 2006). In Illinois, the 2010 score reports showed that students scored at a significantly lower rate than the national level in all four benchmarks, however, in terms of gender, composite scores were similar (males = 20.8, females = 20.6). At the national level, males scored higher in math and science and females scored higher in reading and composition. Some researchers have interpreted these inconsistencies to be attributed to those who make biased, single-statement summarizations of articles on the side of those referencing them. Other interpretations include a less fallacious account of different socio-cultural value systems in different parts of the world to help explain why studies are reporting different results (Lohman & Lakin, 2009; Marks, 2008).

Relaxation and Deep Breathing

Progressive relaxation had its start in the early 20th century by Edmund Jacobson who introduced a physiological way of dealing with tension and anxiety (Bernstein, Borkovec, & Hazlett-Stevens, 2000). Jacobson wrote, "You Must Relax," in 1934 for those interested in

learning about muscle relaxation in a way simple enough to follow as a layperson. His actual research came together in 1938 in an extensive book-length technical instruction of, "Progressive Relaxation." Since then, a plethora of research supporting the uses of a systematic relaxation technique on a multitude of symptoms that ranges from anxiety to speech distortions to blood glucose levels in the management of diabetes (Detling, 2008; Ganesan, 2009; Grant, 1980). Rasid and Parish (1998) conducted a study examining the effects of two types of relaxation training using 55 high school students with varying levels of anxiety in an experimental-control group design. Results showed that both behavioral relaxation and progressive muscle relaxation techniques produced significantly lower anxiety scores in the experimental group as compared to the control group. The authors also found that the use of progressive muscle relaxation led to reduced test anxiety in high school juniors in preparation for the ACT (1998).

For the purposes of this study, students who participated in this experiment comprised of those who participated in an earlier study and who consented to release their ACT scores, as they were all mandated to take the ACT. The hypotheses for this experiment were that 1.) relaxation and deep breathing training would affect participants levels of anxiety and that 2.) relaxation and deep breathing would affect ACT scores for those in the experimental group.

Method

Participants

All eleventh-grade students from a Midwestern high school were invited to participate in the study. Those students who returned a signed parental consent form were included. A signature line for the high school students was included on the parental consent form to indicate participant's assent for the study. Volunteers who participated for this study included 11th grade students from a Midwestern public high school (21 males, 37 females; median age = 17 years). Of the 58 participants, self-reported ethnicities were as follows, 51 Caucasian, 3 African American, 1 Hispanic, 1 Asian American, and 1 who identified as Other. The initial sample size was 85, however, four students unexpectedly dropped out of the study and only 58 participants consented to release their scores.

Measures and Instrumentation

Westside Test Anxiety Scale. The Westside Test Anxiety Scale (WTAS; Driscoll, 2007) was originally designed to identify students suffering from anxiety impairments who could benefit from anxiety reduction. The WTAS consists of 10 items, each using a Likert response scale where 1 = "never true" and 5 = "always true." It yields an overall anxiety score and measures anxiety impairments with six items assessing incapacity (i.e., memory loss and poor cognitive processing) and four items measuring worry and dread (i.e., catastrophizing) which interferes with concentration (Driscoll, 2007). Scores for the two subscales, incapacity (items 1, 4, 5, 6, 8, & 10) and worry (items 2, 3, 7, & 9), are obtained by summing the respective item responses; a total score is obtained by adding up the scores and dividing by 10 (Grimes & Murdock, 1989) where higher scores indicate a greater level of test anxiety. In the present study, the total score was obtained in order to measure a general level of test anxiety.

Deep breathing instructions were obtained from an online reference (Anxiety Community, 2010). Selection for this method was utilized due to the simplicity and applicability to high school students under a limited amount of time. The guided progressive muscle relaxation technique was selected for the purposes of focusing on all parts of the body from feet to head (Unknown).

Procedures

All participants were given the WTAS (pre-test) and a short demographic questionnaire to complete during their physical education class and participant's pre-test scores were rank-ordered from highest to lowest and then divided in half creating homogenous groups. Participants with the highest anxiety scores were then assigned to the experimental group (N = 37), and the rest of the participants were assigned to the control group (N = 44).

The control group participated in physical education as normally expected while the experimental group met in the wrestling gym where there were mats available for the students to lay down and the lights were dimmed to create a relaxing environment. Training took place at school, two days a week, over a five-week period leading up to the actual standardized testing date. On training days, we began by discussing the upcoming standardized test which included the ACT to elevate levels of anxiety. During training, relaxing music was played in the background. While in training, participants in the treatment group were taught both deep breathing exercises and progressive muscle relaxation. Participants practiced breathing exercises for five to ten minutes at the beginning of each session and then proceeded through the progressive muscle relaxation for the following 15-20 minutes. At the conclusion of the five weeks, participants in both the experimental and control groups completed the Westside Test Anxiety Scale as a post-test measure of anxiety.

Results

Data was obtained through SPSS using an independent samples t-test and a bi-variate, pearson product-moment correlation coefficient with a significance level of .05. Results showed a significant difference of post-test scores between the experimental (M = 23.31, SD = 8.01) and control (M = 30.55, SD = 6.23) groups, $t(56) = -3.84, p < .001$. Table 1 summarizes these findings. A significant difference was not shown between ACT scores and the experimental (M = 23.31, SD = 5.63) and control (M = 22.27, SD = 4.66) groups, $t(56) = .762, p < .449$. Table 2 summarizes these findings. Relationships were found among gender and those planning to attend college, $r(58) = -.31, p < .05$; gender and post-test scores, $r(58) = .28, p < .05$; ACT scores and pre-test measures, $r(58) = -.41, p < .01$. Table 3 summarizes these findings.

Table 1

The means and standard deviations of the ACT score and post-test scores for the experimental and control groups.

| | Experimental | | | Control | | |
|------------------|--------------|---------|---------|---------|---------|---------|
| | N | M | SD | N | M | SD |
| ACT Score | 29 | 23.3103 | 5.6322 | 29 | 22.2759 | 4.66673 |
| Post Test Scores | 29 | 23.3103 | 8.01384 | 29 | 30.5517 | 6.23118 |

Table 2

Independent Samples Test for the ACT score and Post-Test scores for the experimental and control groups.

| Experimental and Control Group | | | |
|--------------------------------|---------|--------|----|
| | Sig. | t | df |
| ACT Score | .449 | .762 | 56 |
| Post-Test Scores | <.001** | -3.841 | 56 |

Table 3

Correlation Matrix of gender, students who are planning on attending college, pre-test total score, post-test total score and the ACT score.

| Variables | 1 | 2 | 3 | 4 | 5 |
|------------------------------|--------|--------|--------|--------|---------|
| 1. Gender | — | -.306* | .251 | .277* | .179 |
| 1. Plan on Attending College | -.306* | — | -.063 | -.141 | -.122 |
| 2. Pre-Test Total Score | .251 | -.063 | — | .660** | -.407** |
| 3. Post-Test Total Score | .277 * | -.141 | .660** | — | -.197 |
| 4. ACT Score | .179 | -.122 | -.407 | -.197 | — |

*Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Discussion

The present study investigated the effects of relaxation techniques on test anxiety in high school students, specifically, on their ACT scores. Juniors in high school were taught two relaxation techniques; after which the treatment group reported a significant decrease in anxiety as compared to a group of their peers receiving no training. Participants in this study were from ages 16 to 19 years and results supported earlier findings that relaxation techniques can be learned and utilized successfully by children and young adults (Zaichkowsky & Zaichkowsky, 1984; Lohaus & Klein-Hessling, 2003). Results from this study suggested that while treatment and relaxation influenced post-test scores, as indicated in a previous study (Larson, et al., 2011) the treatment appeared to have no direct effect on participants ACT scores, therefore, the null hypothesis was not rejected. A limitation to this study that may also lend itself in explaining how these results were established may be attributed to the fact that this was a sub-sample of participants from an original study, as only a small number consented to release their ACT scores (Larson, et al., 2011). With that said, the independent samples t-test that was conducted utilizing post-test scores on the experimental and control groups, yielded positive results.

The correlational data has indicated that the relationship between gender and whether participants indicated any intention to proceed to college, has suggested that females had a higher tendency to indicate that they were going college as opposed to males, who had a lesser tendency to report this. Alongside this relationship, it can be noted that females also tended to report higher levels of anxiety on their post-test scores, whereas their male counterparts did not.

An interpretation of these findings suggest that females planning to go to college will have higher levels of anxiety regarding their performance on the ACT, due to their future goals of seeking acceptance into a college or university. This interpretation supports earlier theories that females tend to have higher anxiety in terms of seeking college entrance and therefore, supports the concept of making treatment modalities like relaxation and deep breathing available to students who are experiencing test anxiety (Altermatt & Kim, 2004).

The last correlational relationship found to be statistically significant involved ACT scores and pre-test scores. Those with high ACT scores tended to report lower levels of anxiety and those with low ACT scores tended to report higher levels of anxiety on their pre-test measures.

As it stands today, the National ACT Score Report (2010) clearly states that many of the students within the US, despite gender or any other influencing variables are still not ready for college upon graduating high school, based on average scores across states. According to the ACT college readiness standards, benchmark scores for each section of the test are determined to represent the criteria needed for students to succeed in post-secondary education. For example, a score of 18 on the English portion, a 22 on the mathematics portion, a 21 on the reading and a 24 on the science portion are what student ideally would need to make in order to be considered, "college ready." At the national level, 66% of students met or exceeded an 18 on the English portion; 43% met or exceeded a 22 on the mathematics portion; 52% met or exceeded a 21 on the reading portion and 29% met or exceeded a 24 on the science portion. Only 24% of students at the national level met or exceeded criteria in all four areas of the ACT's. In other words, 76% of students graduating from high school in 2010 were not ready for college, based on the ACT standards. Both males and females in the state of Illinois, had scores below the national average ACT college readiness scores (2010). This data is worth noting due to the fact that participants' average ACT scores between experimental and control groups were just barely above the national and state average ACT score.

The averages presented in this study are not robust and arguably not representative of the entire state of Illinois, however, this study suggests that with the combination of high stakes testing and test-anxiety, ACT scores have the potential to increase once effective treatment methods are developed and systematically implemented within high schools. Students in American public schools need interventions to combat the adverse behavioral, cognitive and physiological effects of high stakes testing (Carter, Williams, & Silverman, 2008). The increase in test anxiety among students may be attributed to the increase in distribution of high-stakes testing in American public schools (No Child Left Behind Act, 2002; Black, 2005). This higher anxiety can result in students becoming overly concerned with the consequences of failure (Spielberger & Vagg, 1995), thus adversely affecting their ability and desire to learn (Cheek, Bradley, Reynolds, & Coy, 2002).

It is unlikely that high-stakes testing will be eliminated or significantly reduced in the near future (No Child Left Behind Act, 2002; Triplett & Barksdale, 2005). Schools can play a role in addressing test anxiety by incorporating intervention programs such as relaxation training into the curriculum (Cheek, Bradley, Reynolds, & Coy, 2002). School counselors and teachers can have a scheduled time of day to teach students how to respond to physiological and

psychological responses to anxiety and stress through the utilization of relaxation training. The interventions discussed in this article are brief and not difficult for children to learn. These interventions and techniques can be implemented in the academic environment to mediate anxiety and can be generalized to life skills.

There is also little known of the direct effects that relaxation and deep breathing have on actual test scores. Not enough research emphasizes gender in the context of high stakes testing, however, the inclusion of this in any replication of relaxation and deep breathing treatment methods can be effectively incorporated into a study such as this. Further emphasis on the different methods of relaxation and deep breathing and their effectiveness with high stakes testing should be explored.

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