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Strategies to Alleviate Test and Mathematics Anxiety

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ABSTRACT

The purpose of this study was to determine the effectiveness of two anxiety-reducing techniques in a 7th grade Tier 2 (average) mathematics classroom. Based on the work of Ford, Ford, Boxer, and Armstrong (2012), one of the techniques used was the use of humor. The other technique is the use of visualization (see Shobe, Brewin, & Carmack, 2005). Ultimately, this study sought to determine if either of the anxiety-reducing strategies lowered student's anxiety; if they were effective, which was more effective; and if the strategy had any apparent effect on the students' academic performance.

METHODOLOGY

Two classes were used in this study and the study was broken into two rounds. In the first round, Class A was introduced to the anxiety-reduction technique of "the use of humor" while Class B was a control group. In the second round, Class B was introduced to the anxiety-reducing technique of "the use of visualization" while Class A was the control group.

Effectiveness of the techniques was measured in two ways. First, students took Likert scale evaluations throughout the study period to assess their trait anxiety and their state anxiety during and after quizzes and tests. These evaluations were used to compute students' anxiety scores, which were compared to determine if there was a significant difference in students' anxiety without the introduction of anxiety-reduction technique and during the use of an anxiety-reduction technique. Second, students test and quiz scores were examined for significant differences between when the students used an anxiety-reduction technique and when they did not.

The overall effectiveness of the techniques were examined from the holistic standpoint of an educator and through a t-test ($\alpha = 0.05$).

ANXIETY-REDUCTION TECHNIQUES EXPLAINED

The Use of Visualization

This strategy is based on the work of Shobe, Brewin, and Carmack (2005). It is accomplished by asking students to visualize (imagine) a place, feeling, or event/action which is safe, relaxing, or enjoyable prior to their high-stress task (test or quiz). The process used in this study is based on the process outlined by Sichel (2004), which was also used by Shobe, Brewin, and Carmack. It begins with deep breathing exercises, then progresses to muscle relaxation through flexing and relaxing the muscles, and finally culminates with visualization a safe place, feeling, or action/event.

The Use of Humor

This strategy is based on the work of Ford, Ford, Boxer, and Armstrong (2012). It is accomplished by showing students a humorous cartoon prior to their high-stress task (test or quiz). See cartoons used below.



RESULTS

Figure 1: Class Grades by Groups

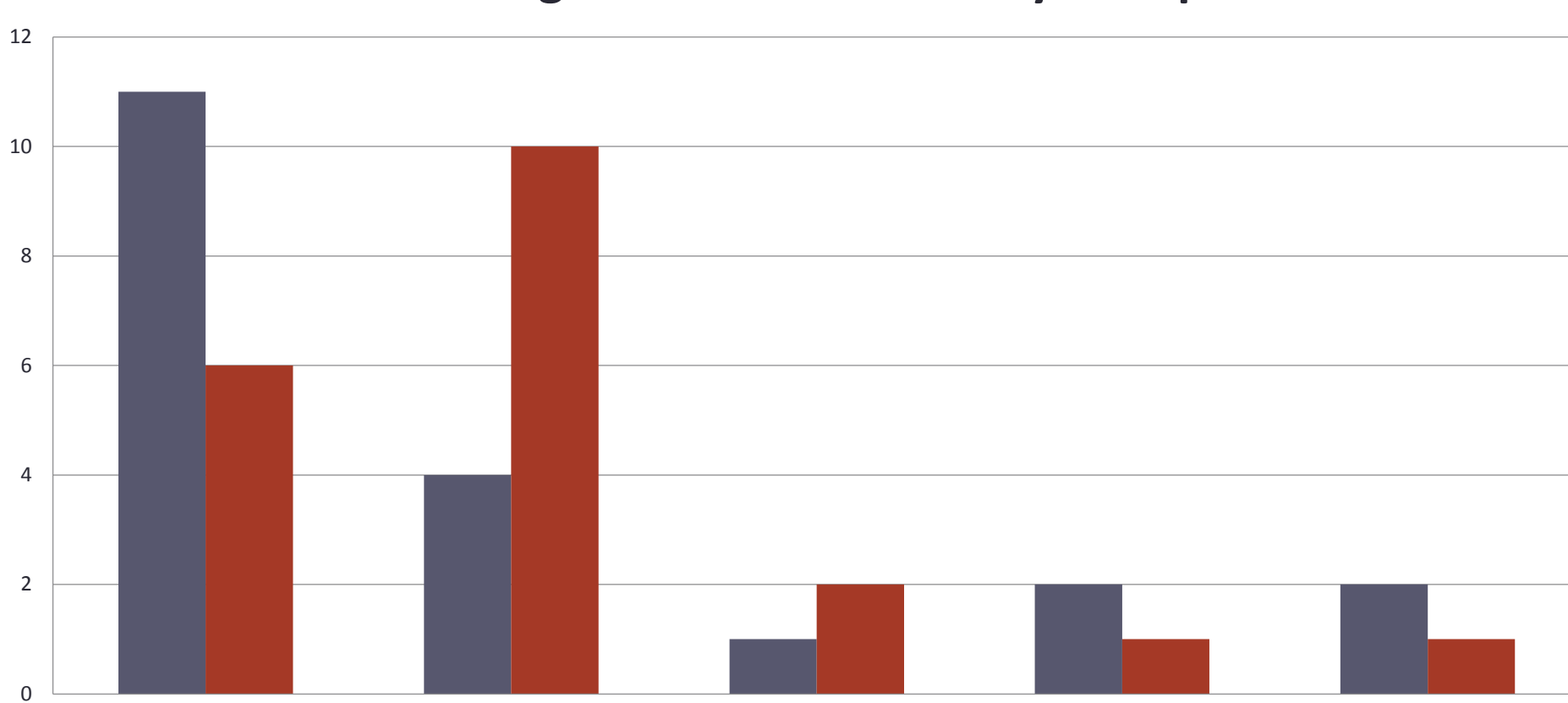


Figure 2: Gender by Groups

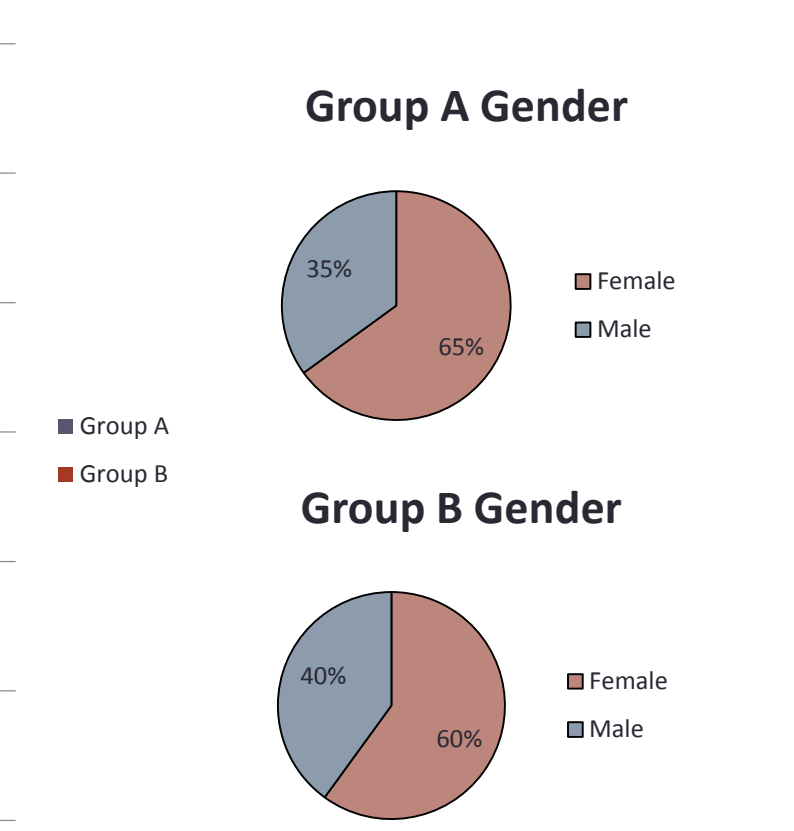


Figure 1 shows the academic composition of the two groups. Group A has more high-achieving students, which may have impacted the test and quiz score comparisons. Figure 2 shows the gender composition of the two groups; it is very similar.

Figure 3: Quiz State Anxiety Change

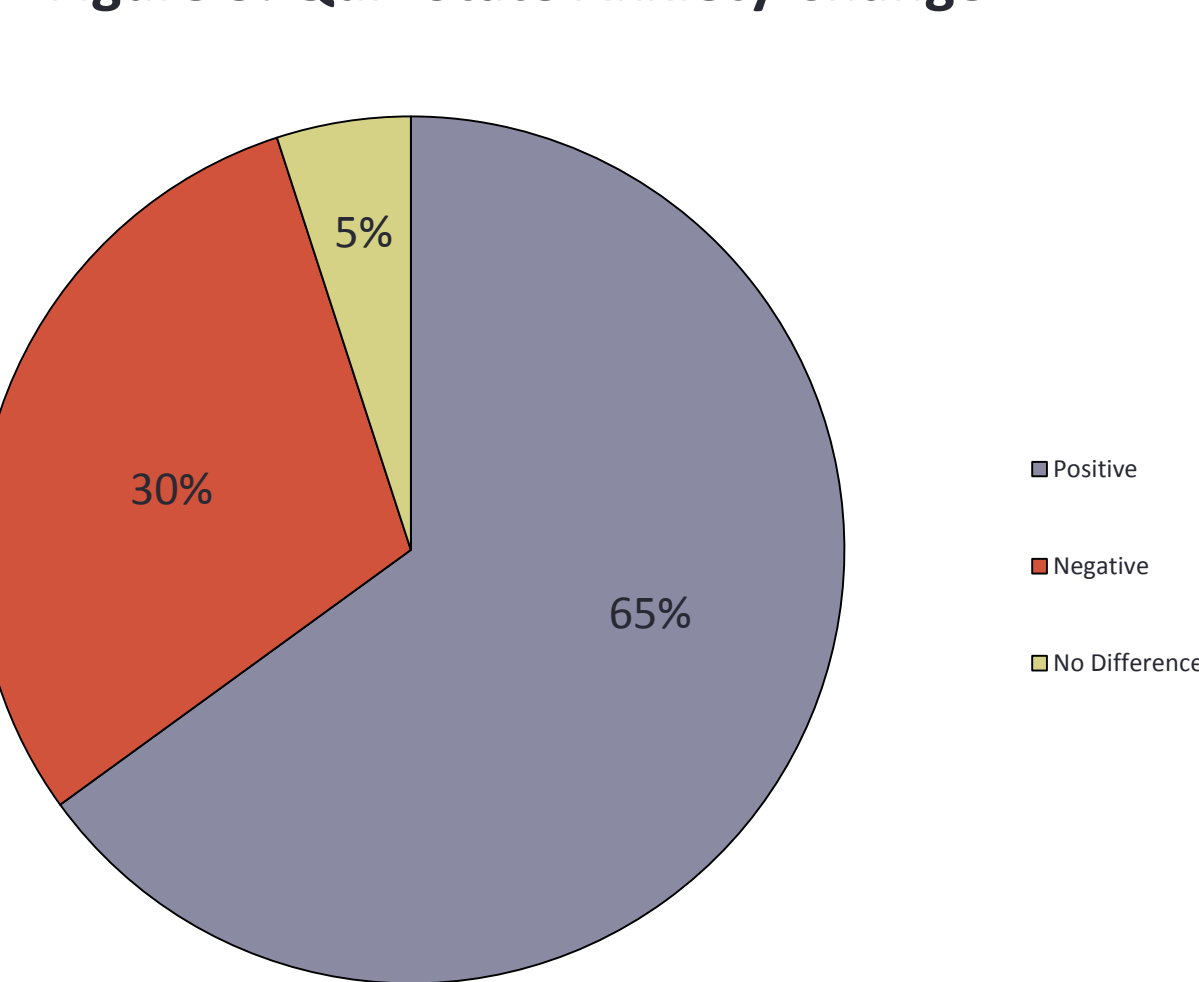
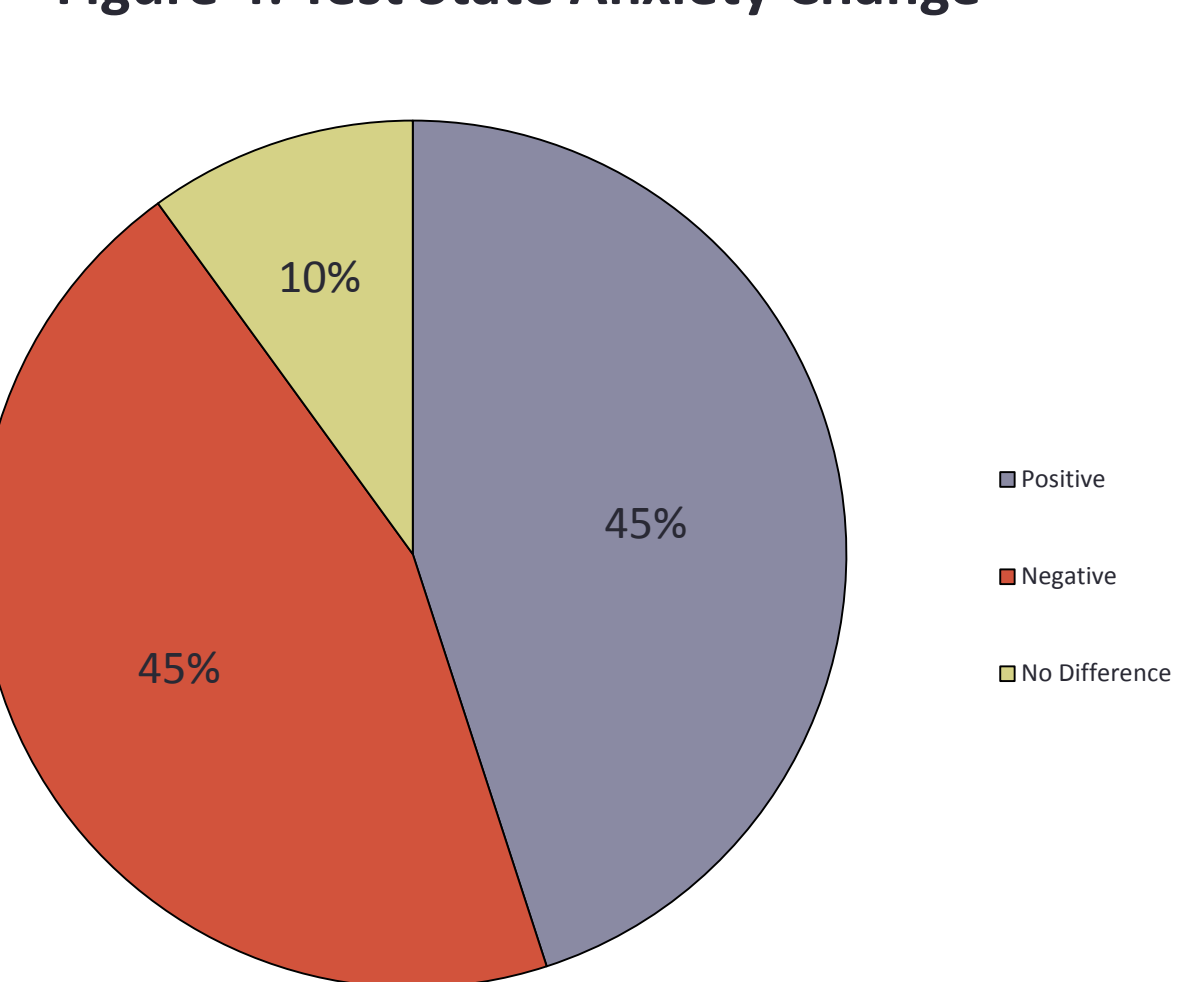


Figure 4: Test State Anxiety Change



Figures 3 and 4 shows the change in students' state anxiety evaluation scores during quizzes and tests, respectively. A positive change indicates that students' anxiety evaluation scores from their experimental round were lower than their anxiety evaluation scores from their control round.

Figure 5: Scope of Trait Anxiety by Group

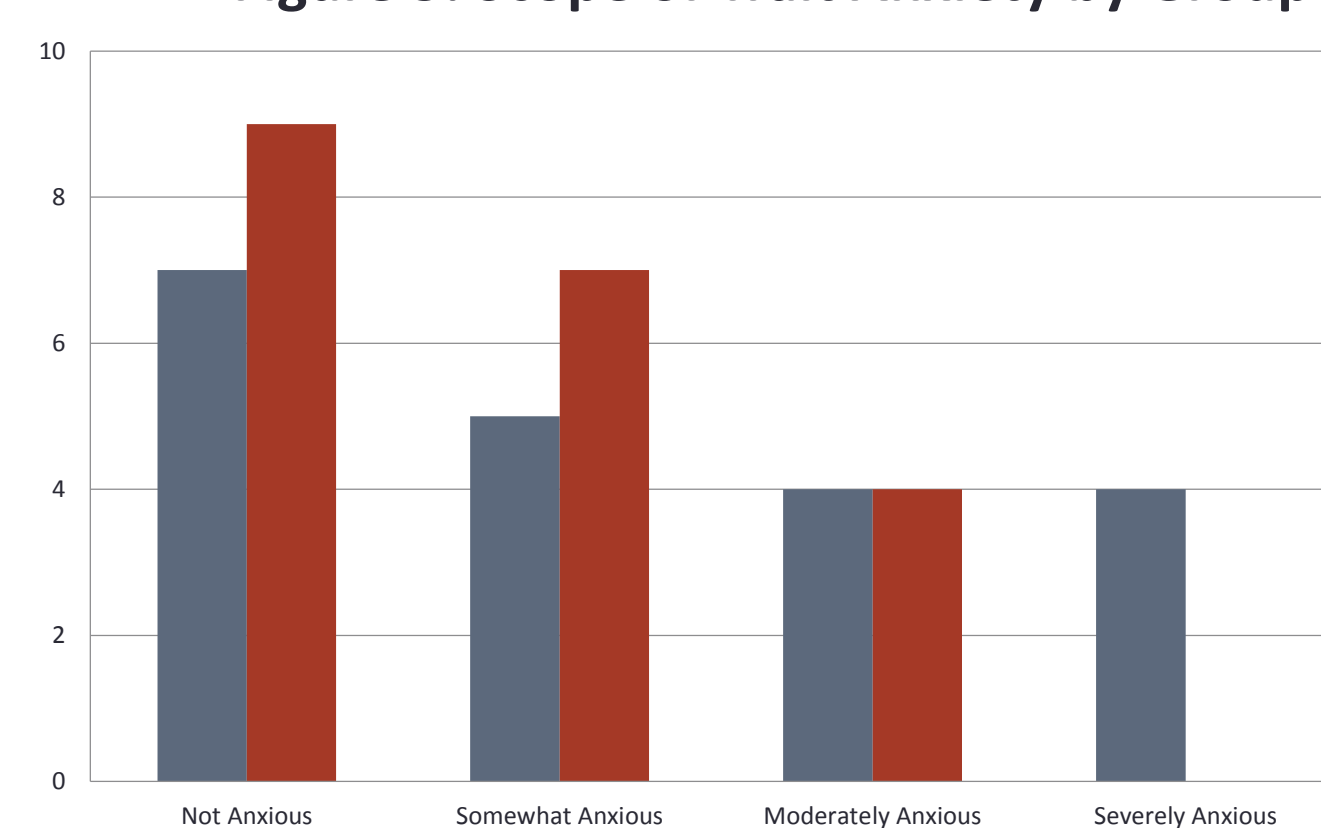


Figure 6: Average Grades on Assessments

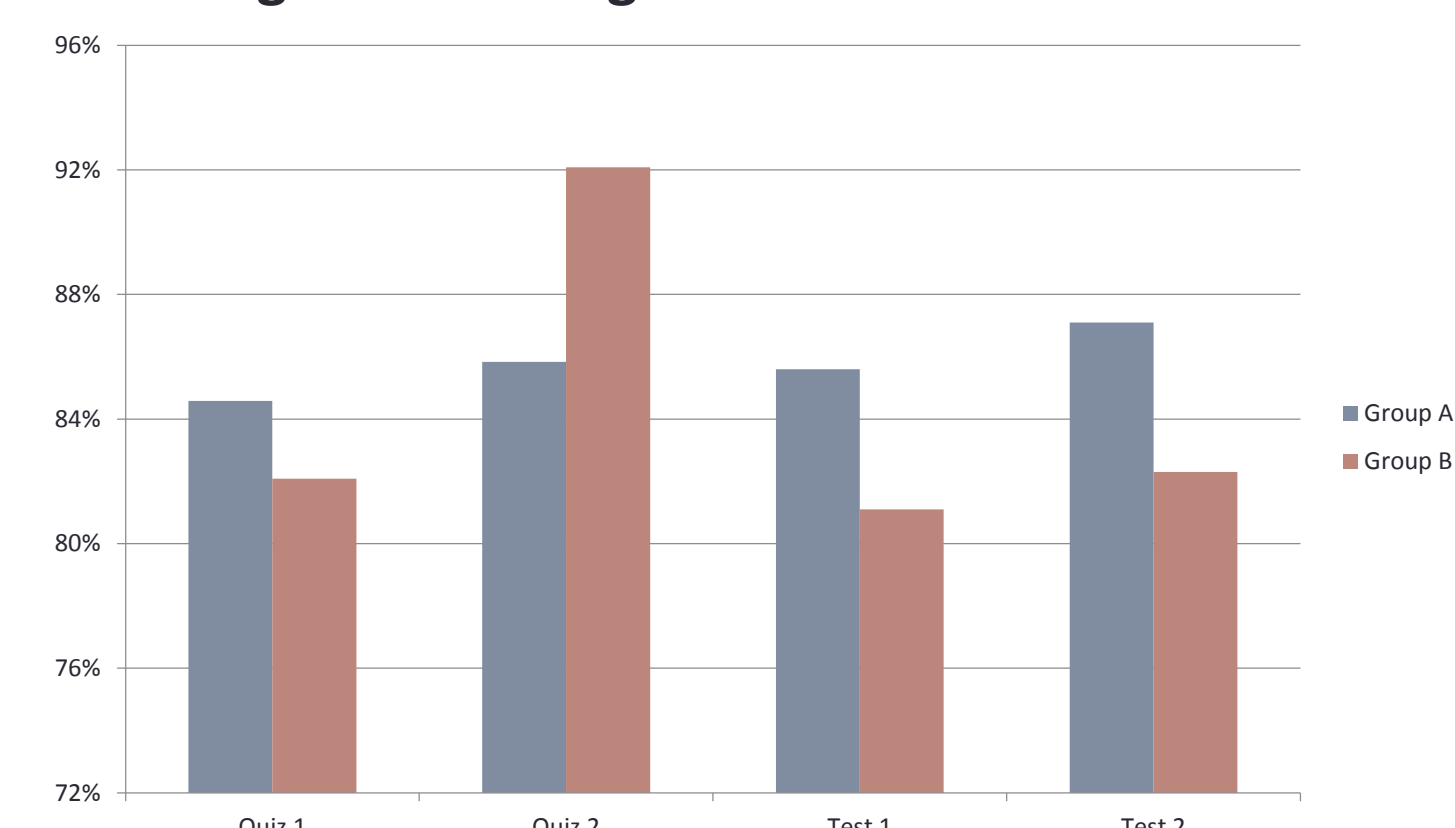


Figure 5 shows the distribution of the two groups' trait anxiety scores. Group A is comprised of more diversely anxious students and contrasts with Group B by having four severely anxious students. Figure 6 depicts the average grades of the two groups on each of the four assessments. With the exception of the second quiz, Group A outscores Group B. Figure 7 (below) displays the t-test results for the null hypothesis "the experimental group will not have higher assessment scores than the control group." All four assessments failed to reject the null hypothesis.

Figure 7: t-Test Results for Assessment Scores

	Quiz 1		Quiz 2		Test 1		Test 2	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Mean	10.15	9.85	10.30	11.05	21.40	20.28	21.78	20.58
Variance	2.661	9.924	3.379	1.839	2.700	11.960	9.012	7.297
Observations	20	20	20	20	20	20	20	20
t Stat	0.378		-1.468		1.314		1.329	
P(T<=t) one-tail	0.354		0.075		0.100		0.096	
t Critical one-tail	1.699		1.690		1.703		1.686	

RESULTS

Figure 8: t-Test Results for Assessment State Anxiety

	Quiz 1		Quiz 2		Test 1		Test 2	
	Group A	Group B	Group A	Group B	Group A	Group B	Group A	Group B
Mean	17.45	15.30	18.65	12.60	19.15	15.85	19.70	15.00
Variance	73.734	49.800	112.976	36.884	83.608	62.239	86.747	51.579
Observations	20	20	20	20	20	20	20	20
t Stat	0.865		2.210		1.222		1.787	
P(T<=t) one-tail	0.196		0.017		0.115		0.041	
t Critical one-tail	1.687		1.697		1.687		1.688	

Figure 8 displays the t-test results for the null hypothesis "the experimental group will not have lower anxiety scores than the control group." The anxiety score data from Quiz 1 and Test 1 failed to reject the null hypothesis, but the anxiety score data from Quiz 2 and Test 2 rejected the null hypothesis.

CONCLUSIONS

The t-test results for the anxiety scores (Figure 8) indicate that the anxiety-reduction technique of the use of visualization is effective. This supports the findings of Shobe, Brewin, and Carmack (2005). However, these t-tests also indicate that the anxiety-reduction technique of the use of humor is ineffective, which contradicts the findings of Ford, Ford, Boxer, and Armstrong (2012).

While the use of visualization may have been effective at reducing students' anxiety, it did not, according to the t-tests for assessment scores (Figure 7) make any significant difference on students' assessment scores, nor did the use of humor. This creates a conundrum: visualization does seem to reduce student anxiety, but it doesn't necessarily affect students' assessment scores, which is where anxiety-reduction techniques could, arguably, be the most useful.

However, there are a few more factors which should be considered. Group A tends to score better on assessments (Figure 6) and is comprised of more high-achieving students (Figure 1). This could have impacted the scores for the assessments enough that no significant evidence of Group B attaining higher scores could be found. Additionally, based on the higher scores from both groups on Test 2 as compared to Test 1 (Figure 6), it could be suggested that the tests were not comparably difficult. Finally, Group A is also comprised of more anxious students (i.e. four severely anxious students compared to no severely anxious students in Group B – see Figure 5) and therefore may not be as receptive to the anxiety-reduction techniques.

Conversely, from the holistic viewpoint of an educator, reduced anxiety in a mathematics classroom is still notable and worthy of future trials so that all students' needs can be met.

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