



NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

UNIVERSITY STUDIES

Memorandum

To: African American Experience Team

From: Dr. Joseph L. Graves, Jr., Dean of University Studies

Date: January 28, 2008

Re: Pre-Post Test Data, Fall 2007

I have finished examining the data you provided me concerning the pre- and post-test scores from the fall 2007 semester. The results are summarized below.

Methods

The data analyzed in this report result from pre- and post-tests administered to students enrolled in the African American Experience in the fall 2007 semester. These tests consisted of 50 multiple choice questions and the results are reported as the percentage of correct answers. Pre-tests were administered in the first week of class before any instruction began on the subject matter of the African American Experience (N = 526.) The post test was comprised of the exact same items, administered at the end of the fall semester (N = 468.) The final comparison contains only 343 students because this was the number that took both the pre- and the post- test.

Results UNST 140 Fall 2007

The pre- and post-test results were analyzed using a paired student's t-test. This is because we can match the score for each student in the pre-test to their corresponding score on the post-test. Table 1 below gives the means, standard deviations, and standard errors for both tests. The mean score for the pre- and post-test respectively were 37.42% and 42.47%.

Table 1 - Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Pair 1 Pretest	37.72	343	13.97	.75
Posttest	42.47	343	16.43	.88

Table 2 represents a Pearson correlation analysis between the pre- and post-test scores for individual students. The correlation coefficient can take values between 0.0 and 1.0, 0.0 refers to no correlation and 1.0 a perfect correlation. The correlation coefficient addresses the question of whether the post-test score of an individual student is predicted by their pre-test score. A high correlation would say that students who did well on the pre-test were also the students who scored high on the post-test. On the other hand a low correlation might have indicated that students' post-test scores were not at all predicted by their pre-test. The correlation coefficient was very high at 0.911 and was highly statistically significant ($p < 0.0001$.)

Paired t-test Results

Table 2 -Paired Samples Correlations

	N	Correlation	Sig.
Pair 1 Pretest & Posttest	343	.911	.000

Table 3 reports the results of the paired sample student's t-test. The mean difference between the pre- and post-test was -4.746 percentage points (the sign is negative in the table because the post-test mean was subtracted from the pre-test mean.) The t value of -12.815 is highly statistically significant ($p < 0.0001$.)

Table 3 - Paired Samples Test

Parameter	
Mean Diff.	-4.746
SD	6.859
SE	0.370
95% Confidence Interval	-4.017 -- -5.474
t	-12.815
df	342
Significance (2-tailed)	0.0001

Figure 1 represents a histogram of paired differences for individual students. The paired difference was calculated by subtracting the pre-test score from the post-test score. This means that negative differences result when a student scored worse on the post-test than on the pre-test. The histogram reveals that a significant number of students (20.7%) had scores on the post test that were equal to or less than their pre-test (Table 4.)

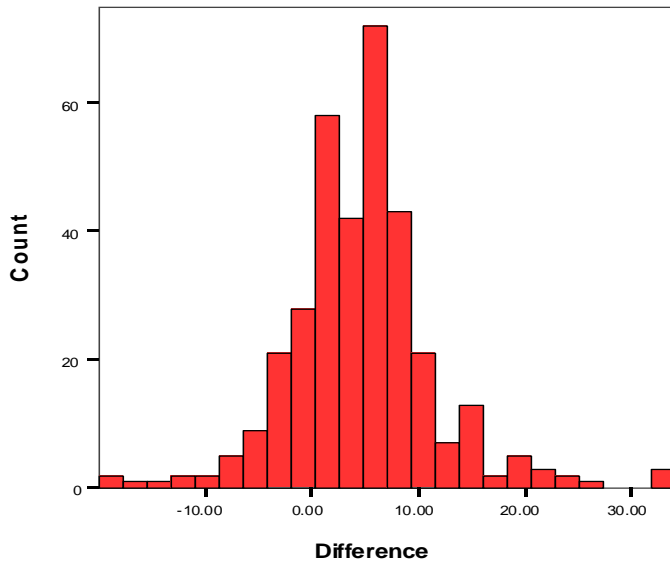


Figure 1 – Frequency Histogram of Differences in Pre-, Post-Test Scores

Table 4 reports the frequency of differences, the percent of that frequency, and the cumulative frequency of differences.

Table 4 - Frequency of Differences

Difference	Freq	Percent	Cum. Percent	Difference	Freq.	Percent	Cum. Percent
-20.00	2	.6	.6	7.00	15	4.4	70.8
-16.00	1	.3	.9	8.00	32	9.3	80.2
-14.00	1	.3	1.2	9.00	11	3.2	83.4
-12.00	1	.3	1.5	10.00	18	5.2	88.6
-11.00	1	.3	1.7	11.00	3	.9	89.5
-10.00	1	.3	2.0	12.00	6	1.7	91.3
-9.00	1	.3	2.3	13.00	1	.3	91.5
-8.00	2	.6	2.9	14.00	5	1.5	93.0
-7.00	3	.9	3.8	15.00	1	.3	93.3
-6.00	2	.6	4.4	16.00	7	2.0	95.3
-5.00	7	2.0	6.4	18.00	2	.6	95.9
-4.00	4	1.2	7.6	19.00	2	.6	96.5
-3.00	8	2.3	9.9	20.00	3	.9	97.4
-2.00	9	2.6	12.5	22.00	3	.9	98.3
-1.00	11	3.2	15.7	24.00	2	.6	98.8
.00	17	5.0	20.7	26.00	1	.3	99.1
1.00	16	4.7	25.4	32.00	2	.6	99.7
2.00	42	12.2	37.6	34.00	1	.3	100.0
3.00	18	5.2	42.9	Total	343	100.0	
4.00	24	7.0	49.9				
5.00	26	7.6	57.4				
6.00	31	9.0	66.5				

Conclusion: Comparison of the pre- and post-test results

Students enrolled in the African American Experience in fall semester 2007 increased by 4.74 percentage points on the subject matter represented in the pre- and post-test assessment. While the mean difference was highly statistically significant, it was also extremely modest. The 4.74 increase in this course is the smallest difference so far recorded in the Division of University Studies.

Furthermore, there was a highly statistically significant correlation between an individual student's pre- and post-test score. This can be interpreted as a failure of instructional intervention to alter the level of understanding of individual students relative to each other. For example, if the mean post-test score was higher than the pre-test, and no or a weak correlation between an individual's pre- and post-test score had been calculated, that might indicate that the instruction in the course had been transformative for some students. In other words, a "D" student coming into the class, might have been transformed into an "A" student at the end. Conversely, if the mean score had decreased on the post-test, and there was no correlation between an individual's pre- and post-test score, that would have indicated that the course was transformative in a negative way (instruction made good students into bad.)

There are significant limitations of the pre- and post-test method to measure student learning alone. For example, the tests did not off themselves measure all of the course's learning objectives. Group work and collaboration skills would not have been measured by this analysis. Better metrics associated with these learning objectives can be gathered from the assessment of the group projects. Hopefully some of the data required to achieve this will be included in the formative assessment reports that all faculty are required to submit to my office by January 31, 2008.

Finally, the data on pre- and post-test scores were not submitted in a way that would have made a full analysis of their significance possible. For example, data should have been submitted by section and instructor. In this way, comparisons could have been made between individual instructors, sections, or even time of day to determine if factors separate from quality instruction played a roll in the outcome. If these data are available in a format that allows this analysis, I would be happy to rerun this data for the team.



NORTH CAROLINA AGRICULTURAL AND TECHNICAL STATE UNIVERSITY

UNIVERSITY STUDIES

Memorandum

To: African American Experience Team

From: Dr. Joseph L. Graves, Jr., Dean of University Studies

Date: July 1, 2008

Re: Pre-Post Test Data, Spring 2008

I have finished examining the data you provided me concerning the pre- and post-test scores from the spring 2008 semester. The results are summarized below.

Methods

The data analyzed in this report result from pre- and post-tests administered to students enrolled in the African American Experience in the spring 2008 semester. These tests consisted of 26 multiple choice questions and the results are reported as the number of correct answers. Pre- and post-tests were administered in the first week of class before any instruction began on the subject matter of the African American Experience (N = 786). The data reflect only those students who took both pre- and post-test assessments.

Results UNST 140 Spring 2008

The pre- and post-test results were analyzed using a one-way analysis of variance. Table 1 below gives the means and standard deviations for both tests. The mean score for the pre- and post-test respectively were 59% and 65%.

Table 1 – Means and Standard Deviation for Pre- and Post-test

Exam	Mean	N	Std. Deviation
Pre-	15.26	786	2.52
Post-	16.84	786	2.41

Table 2 represents the Analysis of Variance to test whether the mean scores of the pre- and post-test assessments were statistically significantly different.

Table 2: Tests of Between-Subjects Effects

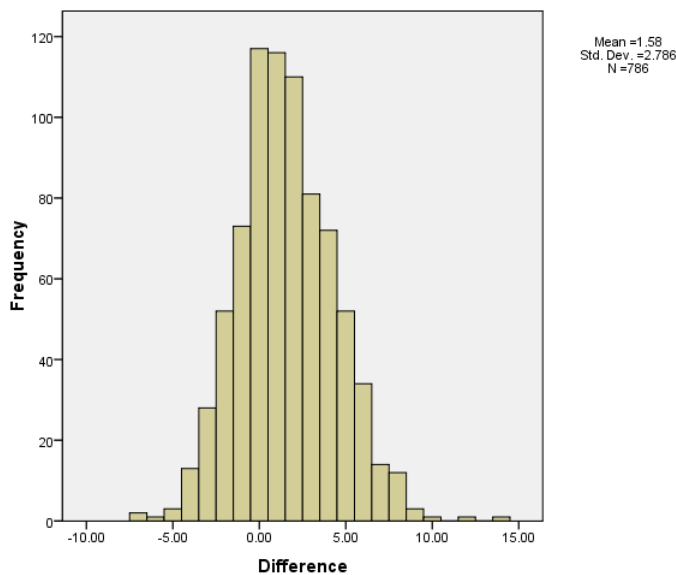
Dependent Variable: Score

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	978.117 ^a	1	978.117	160.595	.000
Intercept	404867.674	1	404867.674	66474.417	.000
Exam	978.117	1	978.117	160.595	.000
Error	9562.209	1570	6.091		
Total	415408.000	1572			
Corrected Total	10540.326	1571			

a. R Squared = .093 (Adjusted R Squared = .092)

The F ratio was = 160.59 and was significant at $p < 0.0001$. This means that while the difference between the means was small, it was significant. Thus students performed at about 6% greater on the post-test. While the mean increase was modest, this resulted from the fact that many students did worse on the post-test, obscuring the gains made by the majority of students. This can be observed in figure 1 which shows the histogram for the differences between pre- and post-tests.

Figure 1: Frequency Histogram of Pre- and Post-Test Differences.



Thus, 49.5% of the students enrolled improved their score by at least 1 point of 26 possible, 24.2% by 3 points of 26 (~10% increase in score), and 9.4% by 5 points (~20% increase in score.)

Differences due to instructor

The data was collected so that it could be analyzed by instructor. To determine if there was an instructor effect on the pre- and post-test scores, an ANOVA was run by instructor. Table 3 reports that analysis and shows that $F = 0.454$, indicating no instructor impact on student scores. Figure 2 is a box plot illustrating the mean scores for difference in pre- and post-test by instructor.

Table 3: Tests of Between-Subjects Effects

Dependent Variable: Difference

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	14.139 ^a	4	3.535	.454	.769
Intercept	1471.146	1	1471.146	189.048	.000
Instructor	14.139	4	3.535	.454	.769
Error	6077.627	781	7.782		
Total	8048.000	786			
Corrected Total	6091.766	785			

a. R Squared = .002 (Adjusted R Squared = -.003)

Figure 2: Box Plot of Pre- Post Test Difference

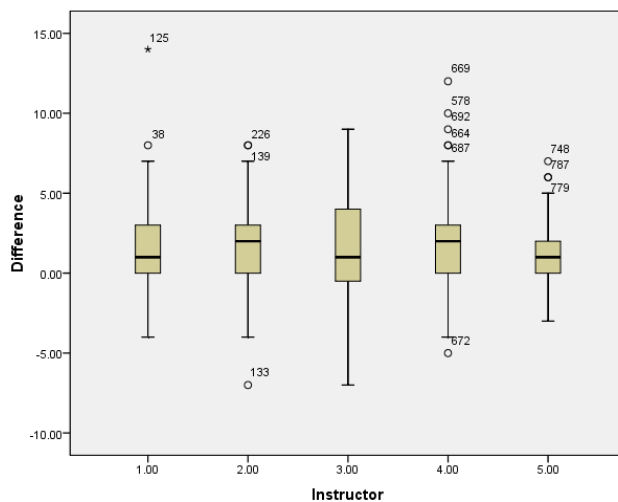


Table 4: Mean Difference by Instructor

Instructor	Mean	N	Std. Dev.
1	1.60	126	2.75
2	1.57	140	2.69
3	1.52	280	2.93
4	1.76	178	2.82
5	1.24	62	2.25
Total	1.57	786	2.78

Conclusion: Comparison of the pre- and post-test results

In fall semester 2007 students increased by 4.74 percentage points on the subject matter represented in the pre- and post-test assessment. Spring 2008 data are consistent with these results showing approximately a 6% increase. Again, while the mean differences are highly statistically significant, they are also extremely modest. These are still the smallest differences so far recorded in the foundation courses within the Division of University Studies. For example, in fall 2007 Critical Writing recorded an 8.3% increase in student writing ability based on the Criterion rubric, while Analytical Reasoning routinely returns ~20% increases as measured by its pre- and post-test assessments.

However, the data do not indicate that the course is failing all of its students. The frequency of difference data indicate that some students are improving their performance by more than modest amounts, e.g. in spring 2008, 35.5% of the students improved by greater than 10% on the post-test assessment. In other words, at least 1/3 of the students would have improved by a least a letter grade.

Finally, we are still aware that there are significant limitations of the pre- and post-test method to measure student learning alone. For example, the tests did not off themselves measure all of the course's learning objectives. Group work and collaboration skills would not have been measured by this analysis. We still need to do a quantitative analysis of the metrics associated with the learning objectives associated with the assessment of the group projects.