Brasili, Watts, Wilborn
3.16.2020
MATH 301.04

Longwood's Leadership: Significant or Not?

Longwood University, along with hundreds of colleges and universities, occasionally participates in the National Survey of Student Engagement (NSSE) to compare their institution to others. For this report, we chose to focus only on colleges and universities within the Southeast region of the United States. We compared Longwood University with Auburn University, Virginia Polytechnic Institute and State University, and Dalton State College.

We chose to analyze question 11b of the NSSE which essentially asks, "Have you held or do you plan to hold a formal role in a student organization or group?" We looked at only senior's responses, as seniors have had more time at the school to pursue and accomplish organizational leadership. We chose to analyze this question because Longwood places a strong emphasis on their students becoming "citizen leaders". Therefore, we would like to see if student organizational leadership is more pronounced at Longwood than at the other schools in the Southwest region.

The four possible answers to question 11b were, "Do not plan to do," "done or in progress," "have not decided," or "plan to do." We entered every student response from each school into IBM SPSS before running the test. Because we needed quantitative data, we did an automatic recode of the four response options;

1 - Do not plan to do
2 - Done or in progress
3 - Have not decided
4 - Plan to do

To begin our hypothesis test, we first chose a null and alternative hypothesis. Our null hypothesis states that the mean response from Longwood, Virginia Tech, Auburn, and Dalton are all equal to each other. In this instance, that would mean that no school has more pronounced student organizational leadership than another. Our alternative hypothesis states the opposite; that the mean response of at least one school is not equal to the others. This could manifest as any combination of the four schools, and thus appears as;

$$\mu \text{ Longwood} \neq \mu \text{ Auburn } \underline{\text{OR}} \ \mu \text{ Longwood} \neq \mu \text{ VT } \underline{\text{OR}} \ \mu \text{ Longwood} \neq \mu \text{ Dalton } \underline{\text{OR}} \ \mu \text{ Auburn} \neq \mu \text{ VT } \underline{\text{OR}} \ \mu \text{ Auburn} \neq \mu \text{ Dalton } \underline{\text{OR}} \ \mu \text{ VT} \neq \mu \text{ Dalton}$$

The next step of the hypothesis test is to state our parameters in context. µ Longwood is equal to the mean NSSE responses to question 11b from seniors at Longwood University. µ Auburn is equal to the mean NSSE responses to question 11b from seniors at Auburn University. µ VT equals the mean NSSE responses to question 11b from seniors at Virginia Polytechnic Institute and State University, and µ Dalton equals the mean NSSE responses to question 11b from seniors at Dalton State College.

For the next step, we must identify our test and conditions. We are running a One-Way ANOVA to analyze our data, which must satisfy three conditions.

First, the samples must be four independent simple random samples. Because taking the NSSE survey was optional for the students involved, there is no way to know if they were simple random samples. We must assume that the sampled students are representative of their respective populations, and use caution.

Next, our population standard deviations must be unknown. They are indeed unknown, but we must also be able to assume that they are the same. Using descriptive statistics within SPSS, the standard deviations for the four schools are as stated;

Auburn = 0.749
Dalton = 0.913
Longwood = 0.647
VT = 0.729

To determine whether the population standard deviations are the same, we must take every combination of the four universities and divide the larger standard deviation by the smaller. If the resulting answer is less than two, we can assume that they are the same. Proceeding with those calculations, our results are stated below. Since every combination is less than two, we can assume the population standard deviations are the same.

Dalton/Auburn = 1.219
Dalton/Longwood = 1.4111
Dalton/VT = 1.2524
Auburn/Longwood = 1.1577
Auburn/VT = 1.0274
VT/Longwood = 1.1267

The last condition is to analyze the shape and size of the data. To do so, we looked at a box plot of each sample.
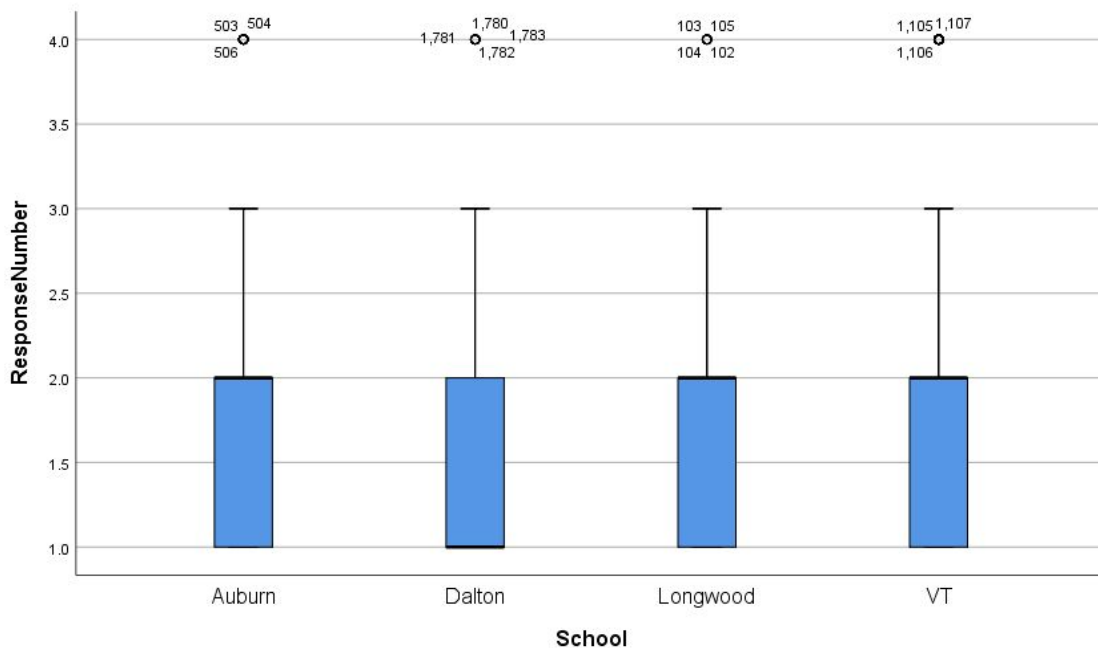
Auburn has a sample size of 437 with a boxplot showing strong skew and 3 outliers. Dalton has a sample size of 172, also with a strong skew and four outliers. Longwood has a sample size of 291 with a boxplot showing strong skew and four outliers. Lastly, VT has a sample size of 923, also with strong skew and 3 outliers.

With a strong skew in any category, our n would have to equal at least 40. Our total sample size is 1,823 - thus, we can continue with the test. However, the presence of outliers is not ideal which tells us to proceed with caution.

Due to the large amount of data, we chose a significance level (α) of 0.05 for step 4. We then proceeded to conduct the actual test. Within SPSS, we navigated to the One-Way ANOVA test. The test gave us our F statistic, which represents the ratio between groups to within the groups' variances. The goal of the F statistic is to be close to 1. Our F statistic for this test equalled 2.973. We were also given a p-value, which represents the statistical significance of the difference between our means and allows us to assess the alternative hypothesis. Our p-value equalled 0.031, which suggests significant evidence to the alternative hypothesis that at least one pairing of schools' means are not equal.

To assess exactly which category may be unequal, we ran a Bonferroni. The purpose of a Bonferroni is to compare a set of tests to determine which are significant. The significance levels of each school pairing are as follows;

Auburn / Dalton = 1.0
Auburn / Longwood = 0.646
Auburn / VT = 0.665
Dalton / Longwood = 0.083
Dalton / VT = 0.074
Longwood / VT = 1.0

Our overall p-value equalled 0.031, but according to the Bonferroni, no category had a p-value indicating significance. Additionally, every confidence interval for each pairing included one negative value and one positive. We can assume based on the p-value of 1.0 that the mean responses between Auburn and Dalton were no different, as with Longwood and Virginia Tech. But, unable to discern anything conclusive from the Bonferroni, we conclude based on our original p-value that there is significant evidence of a difference in the mean response of seniors to question 11b of the NSSE - and consequently, a difference in student organizational leadership.