**One-­Way ANOVA Demonstration**

**Program Transcript**

MATT JONES: This  week  we're going to be introducing you to one-­way  ANOVA. This  is  a comparisons-­of-­means  test. Let's go to SPSS  to see how we'll perform  this  specific  test. To perform  the one-­way  ANOVA  in SPSS, we start up at the Analyze tab. If we click  that, we get a dropdown menu.

Since one-­way  ANOVA  over  is  a comparisons-­of-­means  test, we can move our  cursor  down to Compare Means, scroll across, and we see that one-­way  ANOVA  is  down at the bottom. If we click  on that, a dialog box  is  opened up, where we have a Dependent List and a Factor. For  one-­way  ANOVA, our  dependent variable needs  to be a metric  level variable. That is  it's an interval or  ratio level of measurement. This  is  important because one one-­way  ANOVA  compares  means  across  a factor.

The factor  is  our  grouping variable. This  needs  to be a categorical variable. Typically, one-­way  ANOVA  is  used with grouping variables  that have three or  more levels  or  attributes  to them. In this  case, let's go ahead and test whether  the means  of the socioeconomic  status  index  differ  across  a respondent's highest degree.

To begin with, well, we'll go ahead, and we'll put socioeconomic  status  index  into our  Dependent List box. So you can see off to the left are choice of variables. Socioeconomic  Status  is  down towards  the bottom  of our  Variable list. If I place my cursor  over  it, we'll see it highlighted. You'll also note, again, a little scale

ruler  off to the left, which indicates  that this  is  an interval-­ratio-­level variable.

Once I click  on that variable, it's highlighted. I can just simply  click  on the arrow box, which moves  that variable over  into the Dependent List. Now I need to make sure and enter  my factor  as  well. I'll scroll up till I find Respondents  Highest Degree. I can see that it's right here. I can hover  over  this  variable and then highlight it.

Again, click  on my  arrow that places  it into the Factor  box. For  basic  omnibus  ANOVA  test, we are finished. We can go ahead and click  OK  and examine our  output. This  is  the SPSS  one-­way  ANOVA  omnibus  output. You can see here Respondent Socioeconomic  Index  is  our  dependent variable.

SPSS provides  us  with information about between-­groups  and within-­groups  variance. The between-­groups  variance is  a squared deviations  between the groups. The within-­groups  variance, also known as  unexplained variance, is  the variance within the sample. A  ratio of the mean square of between groups  to within groups  is  how we obtain the F-­value. The F statistic  is  a critical value that determines  the significance of our  test.

Here we can see that the significance level is  0.000. This  significance level is  well below the conventional threshold of 0.5. Therefore we can reject the null hypothesis  that there are no differences  in socioeconomic  status  index  across  respondents  highest degree. To find out where possible differences  lie, we have to perform  a post-­hoc  test.

To perform  a post-­hoc  test, we once again go back  up to our  Analyze, Compare Means, One-­Way  ANOVA. We can click  on Post-­Hocs, in here you'll see that there are a variety  of options  provided for  you. We have equal variances  assumed and equal variances  not assumed. At this  point, we don't know that whether  we have equality  of variances, and this  is  something that we specifically  have to test for.

But as  you're performing the one-­way  ANOVA  test, you can choose an equal variances  assumed test, an equal variances  not assumed test, and then on your  output, go to the appropriate test after  examining the variances. So we can click  on a Bonferroni Test for  equal variances  and also Games-­Howell for  equal variances  not assumed. Click  Continue.

If we click  our  Options  box, this  is  how we determine whether  we have homogeneity  of variances, or  said another  way, equality  of variances. As  you know from  your  reading, this  is  an assumption of the one-­way  ANOVA  test. If we click  on that and activate this  test, going to hit Continue and then click  OK. Right away  you'll see that we get quite a bit more output than we had before.

Our  first piece of output is  the test of homogeneity  of variances, also known as  a Levene's test. This  tests  the null hypothesis  of homogeneity  of variances. Here, if you look  at the significance level, you'll see that we are at 0.000, which is  well below the threshold of 0.05. This  means  we reject our  null hypothesis that variances  are equal. Therefore, we have to assume that the variances  are not equal in the one-­way  ANOVA.

As we noted before, the overall test, also sometimes  referred to as  the omnibus  test, is  significant. Since the omnibus  test is  significant, we know that at least one of the means  differs  from  another. Therefore we need to examine our  post-­hoc  tests  to determine which means  differ. Again, moving with the assumption of inequality  of variances, we have to move down to our  Games-­Howell all Post-­

Hoc  test.

If you remember, we chose Bonferroni as  a test for  equality  of variances, but tested for  the equality  of variances  and found they  were not equal. The Games-­ Howell test performs  a pairwise comparison for  all levels  of our  variable. Here you'll see less than high schools  compared to high school, less  than high school to junior  college, less  than high school to bachelor, less  than high school to graduate, and so forth, until all possible combinations  are achieved.

The next column shows  us  our  mean difference. We can see that on the socioeconomic  status  index, our  dependent variable, those with less  than high school have a mean score of 10.08 units  lower  than high school. If we move over  to our  significance level, we see that, indeed, this  pairwise comparison is  statistically  significant a at the 0.05. Therefore there is  a statistically  significant difference between those with less  than high school and those with a high school degree.

As we move down our  output, we can examine all of these pairwise comparisons. Again, less  than high school to junior  college, there is  a difference of 17.38, and it is  statistically  significant. If we move to a less  than high school to bachelor's, we can see that the difference increases. Again, it is  statistically  significant, and the same is  true for  less  than high school to graduate.

Moving through our  output, we can go ahead and examine all of these pairwise comparisons, move over  to our  significance column, and see that they  are indeed all statistically  significant. You'll notice on the main difference that SPSS  also

puts  an asterisk  next to each mean difference to highlight or  flag those differences  that are statistically  significant. We can conclude from  our  output and

our  post-­hoc  tests  that there is  indeed a difference in socioeconomic  status  index

across  respondents  highest degree and that all pairwise comparisons  are statistically  significant, concluding that the higher  a respondent's degree, the higher  their  socioeconomic  status  index  on average.

And that concludes  our  SPSS demonstration on one-­way  ANOVA. As  a couple of parting thoughts, be sure and remember  that your  dependent variable in one-­way  ANOVA  needs  to be a metric  variable, that is  an interval ratio level of measurement. Your  independent variable, or  your factor, needs  to be a

categorical variable. This  is  because one-­way  ANOVA  of is  a comparison-­of-­

means  test.

Also, it's very  important to test the assumption for  homogeneity  of variances, so be sure and look  at that Levene's test. If you have any  further questions, be sure and use your  textbook. And also, your  instructor  is  a very  valuable resource.