Computing ANOVAs and Post Hoc Testing
Program Transcript

TEACHER: This video will walk you through how to use SPSS to compute ANOVAs and post hoc testing. Consider the example of a professor interested in investigating if various types of classroom environments influence students' evaluations of their instructors. I will show you how to use IBM SPSS statistics software to conduct an ANOVA to determine whether classroom environment effects instructor evaluations. If there is an effect, I will show you how to conduct post hoc testing to determine which environments leads to significantly different evaluation results.

In a study where there is only one factor, classroom environment, you will conduct a one-way ANOVA. Imagine that there are four levels within that factor. In an environment with no windows, one with windows that look out to a parking lot, one with windows that look out to a park, and one with no windows but pictures of windows on the wall.

The same instructor teaches Introduction to Statistics in each of those classrooms, and there are 10 students in each class. Here are the instructor evaluation data. A 10-point interval scale is used. Each number is one student's evaluation of that instructor. The 10 students in the classroom without windows rated the instructor as a 3, 4, 6, 7, et cetera. The 10 students in the classroom windows to the parking lot rated the instructor as a 5, 3, 6, 3, and so on for the remaining groups.

So to get started in SPSS, create a new data file by opening SPSS on your computer. Choose Type in data, and click OK. Click Variable View, and enter in the descriptors for the data by entering the first variable, which is the factor and title it ENVT for environment. Go over to Label and enter Type of Classroom Environment.

Just as it is important to label variables, it is also important to label our values. In this case, you will code No Windows as 1, Parking Lot as 2, Park as 3, and Pictures of Windows as 4. Then click OK. Next, name your dependent variable instructor evaluation as E-V-A-L, EVAL, and put a description in the Label field. Since instructor evaluations are already numeric, you do not have to describe the values in the Values column as you did for the classroom environment.

Now you are ready to enter data. Click on Data View to enter the raw data for analysis. Start with the first group of participants, the No Windows group. You know that the No Windows group is coded as group 1, so you can enter 1’s for the first 10 participants in the ENVT column. Then refer back to the data table and enter the scores in the EVAL column.
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You know that the Parking Lot group is coded as group 2, so you can enter 2's for the next 10 participants in the ENVT column. Again, refer back to the data table and enter the scores in the EVAL column. Do the same for group 3, the Park group, and group 4, the Pictures of Windows group.

Now, you have the factor, type of environment, and dependent variable instructor evaluation data entered for all 40 learners. You are now ready to conduct your analysis. In Data View, click on Analyze, Compare Means, and then One-Way ANOVA. You know that the instructor evaluation, EVAL, is our dependent variable, so click that one into the Dependent list box. You know the type of classroom environment ENVT is your factor, so click that one into the Factor box. But before you click OK, there are a few more pieces of information you can get.

First, click on the Options and check the boxes for Descriptive and Homogeneity of Variance. Test your understanding of homogeneity of variance and descriptive statistics. Do you remember why these two pieces of information are important and should be collected for every analysis? Click Continue.

Now, it is only necessary to compute post hoc testing if the ANOVA is significant. It is easy to request post hoc tests now, before conducting the initial ANOVA test. So we'll go ahead and request them knowing that you will not interpret post hoc results if the ANOVA is non-significant. To do this, click Post Hoc and for the sake of this example, choose Tukey. Do you recall why you would use a Tukey test rather than some of the other tests listed here? Note that the significance level is set to 0.05.

If you wanted to be more conservative, you could change that to 0.01 or 0.001. For this exercise, leave it at 0.05. Click Continue. Now, you're ready to compute the ANOVA, so click OK. Your output document will open, and you will be able to interpret your results. First, you see our Descriptive Statistics table, which includes the Number of Cases in each level, the Mean, Standard Deviation, and Confidence Interval.

Next, you see that you have a non-significant test of homogeneity of variance. Recall what that tells you and why it is important. Next, you see the F test or ANOVA results. The Sum of Squares, Degrees of Freedom, F value, and Significance Levels are all noted. Our test is highly significant with a P value of less than 0.001. This shows that at least one type of classroom environment has a different instructor rating than another.

Post hoc tests tell you exactly which environments differ from one another. Remember that you would not go on to post hoc tests if your results had been non-significant. This table compares each level to each other level pairwise. So for example, the first box compares the No Windows group to each of the other three levels one at the time. It shows that the No Windows environment results in an instructor evaluation score that is significantly different from each other group.
Looking first at the significance levels for the No Windows group, you see that there is not a significant difference between No Windows and Parking Lot or Pictures of Windows, but there is a significant difference between No Windows and Park. This tells you that the students in the classroom with no windows had a significantly different instructor evaluation mean from students in a classroom with windows to a park. It also tells you that there was not a significant difference in mean instructor evaluation scores between the class taught in a room with a view of a parking lot and the class taught in a room with pictures of windows on the wall.

Looking at the Parking Lot group, you see that the only significant differences between Parking Lot group and Park group. When you look at the Park group, you see that this group had significantly different instructor ratings when compared to all three other groups. Just to be sure, take a look at the pictures of Windows box, and indeed, you see that the only significant difference in instructor ratings for this group is with the Park group.

Taking all of that information together, you know that students in the classroom with a window to the park rate there instructors significantly differently from students in other classroom environments. But do they give their instructors higher or lower ratings? To answer this question, go back up to the Descriptives table.

Do you see why it is important to check the Descriptive box before running the analysis? Look at the means and see that the mean instructor evaluation score for the classroom with a view to the park is 8.0. This is higher than the means of the other three classroom environments. The No Window group had a mean of 3.5. The Parking Lot group had a mean of 4.8. The Picture of Windows group had a mean of 4.3. Only now do you have a complete picture.

You can finally interpret that students who take their Introduction to Statistics course in a room with a view of a park give their instructors significantly higher ratings than students who take that same course in a room without a window, a room with pictures of windows, or a room with a view of a parking lot.

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