EDL 7150 Inferential Statistics

Fall 2012

Solution to Out-of-Class Problem No. 2

Dr. Hargorve, Director of Technology, has just completed a study of the benefits of online instruction. He selected, randomly, six students from each of ten Science classrooms. He then randomly enrolled three of the six students from each classroom to participate in a new online science program (Treatment) covering several of the units in the course. The remaing three students in each classroom constituted a Control gorup, and were enrolled in an online program that had been used for the previous three years. At the end of 10 weeks, Dr. Hargrove administered a standardized achievement test over the content of the science units. The test scores are given below. Note that in a few instances students in both the treatment group and control group did not take the test.

Science Achievement Test Scores

	Treatment	Control
Classroom No. 1	31	33
	32	24
	28	29
Classroom No. 2	36	34
	35	31
		32
Classroom No.3	28	26
	29	26
	27	27
Classroom N0. 4	31	30
	25	27
	33	31
Classroom No.5	32	34
	40	35
	38	

	Treatment	Control
Classroom No. 6	37	33
	30	30
	34	31
Classroom No. 7	29	28
	33	31
		30
Classroom No. 8	34	26
	37	34
	37	31
Classroom No. 9	35	29
	40	24
	34	35
Classroom No. 10	32	36
	38	33
	34	34

Your job is to help Dr. Hargove determine whether the new program was effective as measured by the achievement test.

Report your findings on the Forum for discussiong, collaborating, and reporting your results from Out-of-Class Problem 2 on the ning.

Answer:

The key to getting the correct solution to this problem involves choosing the correct *unit of analysis*. Since students, in both conditions (Treatment and Control) are *nested* within classrooms, it can easily be assumed that all the students, within any one classroom have several influences in common. E.g., they have the same teacher, they often are assigned to classroom because they share certain characteristics, classes meet at different times, etc. Therefore, students within classrooms are **not** *independent*—an important assumption in statistical analysis. The way to handle this lack of independence is to compute averages within classrooms, separately, for each group (Treatment and Control). I have done this in Table 1.

Table 1

Class Averages		
Classroom	Treatment	Control
1	30.33	28.67
2	35.50	32.33
3	28.00	26.33
4	29.67	29.33
5	36.67	34.50
6	33.67	31.33
7	31.00	29.67
8	36.00	30.33
9	36.33	29.33
10	34.67	34.33
	r =	0.76

There is still a dependency between the two groups within classrooms. At the bottom of Table 1, I show that the correlation (Pearson, r) is .76. Hence, the class averages for Treatment and Control are correlated. Therefore, a *t* test for correlated samples (paired samples *t* test, dependent samples *t* test) is indicated. Table 2, which was generated using SPSS, displays descriptive statistics for the two groups (Treatment and Control).

Table 2

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Treatment	33.18	10	3.161	1.000
	Control	30.62	10	2.555	.808

The SPSS *Paired Samples Test* analysis is given in Table 3.

We conclude the following:

> "The new online science program resulted in higher scores, M = 33.18, than were observed for the control group, M = 30.62, $t(9) = 3.72$; $p = .005$.

Table 3

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Treatment - Control	2.569	2.184	.691	1.007	4.131	3.720	9	.005

Note, I also computed this analysis in Excel. You can view the (heavily commented) Excel File by clicking HERE.