

Exercise 4

One-factor ANOVA

Researchers at Purdue University conducted an experiment to compare three methods of teaching reading. Students were randomly assigned to one of the three teaching methods, and their reading comprehension was tested before and after they received the instruction.

1. Download the table reading.sav from: http://www.let.rug.nl/~heeringa/statistics/stat03_2013/ and load the table in SPSS.
2. We will investigate the variable 'POST 3'. For this variable we want to test whether the scores obtained for the three reading methods (Basal, DRTA, Strat) differ. Make side-by-side boxplots for the three groups. What would you expect?
3. Formate H_0 and H_a .
4. Perform a one-way ANOVA. See to it that SPSS also saves the residuals and performs a Levene's test. Are the variances the same?
5. Test whether the residuals are normally distributed. Make a normal-quantile plot and run the Shapiro-Wilk test. What do you conclude?
6. Calculate the variances of each of the groups and perform Hartley's test (by hand). Does this test give the same result as the Levene's test?

(Critical values at found at:

<http://www.csulb.edu/~acarter3/course-biostats/tables/table-Fmax-values.pdf>)

7. What do you conclude on the basis of the output of the ANOVA test?
8. Report the effect size.
9. Analyze the contrast '(DRTA & Strat) vs. Basal'. Choose the right contrast coefficients:

$$0.5 \mu_{DRTA} + 0.5 \mu_{Strat} = 1.0 \mu_{Basal}$$

$$0.5 \mu_{DRTA} + 0.5 \mu_{Strat} - 1.0 \mu_{Basal} = 0$$

Therefore the coefficients are: 0.5, 0.5 and -1.0. Enter the coefficients in ascending order of the category values of the factor variable:

$$1 = \text{Basal} (-1.0)$$

$$2 = \text{DRTA} (0.5)$$

$$3 = \text{Strat} (0.5)$$

10. Give also the effect size for this contrast.
11. Perform a post-hoc Bonferroni-test with $\alpha=0.05$. For which group pairs do you find significant differences?