Problem Set #7: Solutions

1. Two students are conducting a class project to determine whether music is a better cue for autobiographical memories than pictures or words. They kind of get their wires crossed so they don’t run the experiment the exact same way. Carrie gives each of her subjects three cues – a song, a picture, and a word (counterbalancing the order). Julia gives one group of students a musical cue, and a separate group of subjects a pictorial cue and a third group a word cue. Which design operationalized cue type (music vs. picture vs. word) as a within subject variable? Explain.

Carrie operationalized cue type as a within subjects variable because each subject was exposed to all three cues.

NOTE: a within-subjects design looks at differences within a subject (such as the difference in ratings a person gives with three different types of cues or at three different points in time). If the within-subjects variable involves only two measurements, then we can analyze the data using a paired t-tests.

1. Do people experience higher emotional well-being when exposed to sunshine? To test this, a researcher recruits a sample of 8 people. She asks them to complete a questionnaire measuring their emotional well-being when they are exposed to high levels of sunshine and then again when they’re exposed to low levels of sunshine. Conduct a t-test to determine if sunshine affects subjective feelings of well-being (Steps 1 through 8). Be sure to interpret the results and report the test statistic correctly. Set alpha at .05.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Person 1 | Person 2 | Person 3 | Person 4 | Person 5 | Person 6 | Person 7 | Person 8 |
| Low | 14 | 13 | 17 | 15 | 18 | 17 | 14 | 16 |
| High | 18 | 12 | 20 | 19 | 22 | 19 | 19 | 16 |

This is a paired t-test because subjects were measured under both conditions, resulting in a pair of scores for each person (high and low).

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Low | 14 | 13 | 17 | 15 | 18 | 17 | 14 | 16 | M= 15.5 |
| High | 18 | 12 | 20 | 19 | 22 | 19 | 19 | 16 | M = 18.125 |
| D | -4 | 1 | -3 | -4 | -4 | -2 | -5 | 0 | ∑ = -21 |
| D2 | 16 | 1 | 9 | 16 | 16 | 4 | 25 | 0 | ∑ = 87 |

NOTE: it doesn’t matter if you subtract high from low or low from high, your final answer regarding the null will be the same.

Step 1: Decide whether you are conducting a one- or a two-tailed test.

You should do a two-tailed

Step 2: Specify the ***NULL*** hypothesis (HO)

Ho: μd = 0

Step 3: Specify the ***ALTERNATIVE*** hypothesis (HA)

Ho: μd ≠ 0

Step 4: Designate the rejection region by selecting α.

α= .05

Step 5: Determine the critical value of your test statistic

Df= 7; tcrit = 2.365

Step 6: Use sample statistics to calculate test statistic.

Remember we are calculating the standard deviation of the difference scores now!



Step 7: Compare *observed* value with *critical* value

Because tobs falls in the rejection region, we will reject the null

Step 8: Interpret your decision regarding the null including an appropriate measure of effect size.

$$Cohen^{'}s d= \frac{M\_{d}}{SD\_{d}}= \frac{2.625}{2.13}=1.23$$

People exposed to high amounts of sunshine **report significantly higher** subjective well-being (M = 18.13) than those exposed to low levels of sunshine (M=15.5), t(7) = -3.51, p < .05. Cohen’s d was equal to 1.23 indicating that this was a large effect.