Example Problems: Dependent Samples Test

Example 1: In the show "The Pickup Artist", "Mystery" (the host) wants the artists in training to change from being plain old AFC's (Average Frustrated Chumps), into master pickup artists. He insists that one way to help increase your confidence and your ability to DHV (demonstrate higher value) is simply to "smell the part". He has each contestant go out to a club and try to get as many digits (telephone numbers) as they can without any cologne of any kind (pre-test). Then he has them go out on the next night to the same club after dousing themselves in "Mystery's Freaky Funk" cologne, to see if the number of digits they receive increases (post-test). The results are shown below. Although Mystery maybe a fashion challenged, is he correct in his assertion that cologne helps when picking up women?

Artist	Pre	Post	Difference (pre - post)
1	14	16	______
2	14	16	______
3	14	12	______
4	6	12	______
5	18	16	______
6	10	12	______
7	18	16	______
8	10	16	______
9	6	5	______
10	10	16	______
11	10	12	-2
12	10	16	-6
13	6	5	1
14	2	9	-7
15	10	12	-2
16	14	12	2
17	10	12	-2
18	10	9	1
19	10	9	1
20	10	12	-2
21	10	16	-6
22	10	12	-2
23	18	19	-1
24	10	12	-2
25	10	9	1
26	6	12	-6
27	10	12	-2
28	14	16	-2
29	10	12	-2
30	10	12	-2
31	10	12	-2
32	10	12	-2
33	10	9	1
34	6	12	-6
35	10	9	1
36	14	16	-2
Mean	**10.556**	**12.417**	**-1.861**
StDev	**3.468**	**3.184**	**2.748**

1. **State Null Hypothesis** $h_0 : \mu_{pre-post}$ ____ 0
2. **Alternative Hypothesis** $h_1 : \mu_{pre-post}$ ____ 0
3. **Decide on α (usually .05)** **α =** _____
4. **Decide on type of test (distribution; *z*, *t*, etc.)**
   Questions to ask:
   a. Can we treat the scores as dependent (e.g. they are from the same person, matched subjects, related subjects, etc.)?
      If Yes, then continue with the dependent samples t-test
      If No, STOP you may need to perform an independent samples t-test
   b. Can we assume a normally distributed sampling distribution?
      In other words, do we have 30+ participants OR a normally distributed population?
      If yes, then continue.
      If no, do not continue, the test cannot be performed.
   c. What is the standard error of the difference?

$$s_{\bar{D}} = \frac{\_\_\_\_\_\_}{\sqrt{\_\_\_\_\_\_}} = \_\_\_\_\_\_\_\_\_\_$$

5. **Find critical value & state decision rule**
   <u>Critical Value</u>
   Questions to ask:
   a. Is this a 1-tailed or a 2-tailed test? __________
   b. It is a t-test, so what are the degrees of freedom (DF)? __________
      Use alpha, the number of tails and the degrees of freedom to look up the critical value in a t-table.

   <u>Decision Rule</u>
   In words: If $t_{observed}$ is larger than $t_{critical}$ reject the null hypothesis

   In numbers: If ________ > _________ reject the null hypothesis.
6. **Calculate test**

$$t_{\bar{D}} = \frac{\bar{D}}{s_{\bar{D}}} = \frac{\_\_\_\_\_\_}{\_\_\_\_\_\_} =$$

7. **Apply decision rule**
   Since, ________(i.e. observed value) _____ (i.e. >, <) _________ (critical value), ____________(i.e. **DO or DO NOT)** reject the null hypothesis.

Example #2: It has long been theorized that mating preferences in many animal groups are driven by a need for offspring to survive and pass on genetic material. This leads to a dichotomy in terms of different mating strategies utilized by male and female members of the species. Female mating preferences are driven by the pursuit of security and protection for the female and her (typically single) offspring, while males are motivated to find the female(s) that will most likely lead to healthy offspring. In humans this manifests itself when we often see women pursuing older (more secure) men and men pursuing younger (more fertile) women. If this is true then we should see a tendency for older men to marry younger women. A random sample of 12 married couples was drawn from the population of married couples in the US (where age is roughly normally distributed). The ages of the husbands and wives are shown below. Do younger women tend to marry older men?

Couple	Husband	Wife	Difference (husband - wife)
1	49	36	
2	74	57	
3	69	58	
4	43	59	
5	40	22	
6	34	23	
7	43	48	
8	31	27	
9	45	24	
10	46	42	
11	61	62	
12	50	48	
Mean	**48.750**	**42.167**	
StDev	**13.130**	**15.338**	**10.715**

8. **State Null Hypothesis** $h_0 : \mu_{husband-wife}$ ____ 0

9. **Alternative Hypothesis** $h_1 : \mu_{husband-wife}$ ____ 0

10. **Decide on α (usually .05)** **α =** _____

11. **Decide on type of test (distribution; *z*, *t*, etc.)**

    Questions to ask:

    d. Can we treat the scores as dependent (e.g. they are from the same person, matched subjects, related subjects, etc.)?

    If Yes, then continue with the dependent samples t-test

    If No, STOP you may need to perform an independent samples t-test

    e. Can we assume a normally distributed sampling distribution?

    In other words, do we have 30+ participants OR a normally distributed population?

    If yes, then continue.

    If no, do not continue, the test cannot be performed.

    f. What is the standard error of the difference?

$$s_{\bar{D}} = \frac{\_\_\_\_\_\_}{\sqrt{\_\_\_\_\_\_}} = \_\_\_\_\_\_\_\_\_$$

12. **Find critical value & state decision rule**

    Critical Value

    Questions to ask:

    c. Is this a 1-tailed or a 2-tailed test? __________

    d. It is a t-test, so what are the degrees of freedom (DF)? __________

    Use alpha, the number of tails and the degrees of freedom to look up the critical value in a t-table.

    Decision Rule

    In words: If $t_{observed}$ is larger than $t_{critical}$ reject the null hypothesis

    In numbers: If ________ > _________ reject the null hypothesis.

13. **Calculate test**

$$t_{\bar{D}} = \frac{\bar{D}}{s_{\bar{D}}} = \frac{\_\_\_\_\_}{\_\_\_\_\_} =$$

14. **Apply decision rule**

    Since, ________(i.e. observed value) _____ (i.e. >, <) _________ (critical value), ___________(i.e. **DO or DO NOT)** reject the null hypothesis.