MATCHED PAIRS T TEST

*This test is used to compare the responses to a treatment in a **within-groups** design (ie, does an SAT prep course improve an individual's SAT scores?).*

A listening test with a maximum score of 36 was administered to Spanish teachers before and after an institute designed to improve Spanish listening skills.

Sub	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Pre	30	28	31	26	20	30	34	15	28	20	30	29	31	29	34	20	26	25	31	29
Post	29	30	32	30	16	25	31	18	33	25	32	28	34	32	32	27	28	29	32	32

Determine if the institute improved listening skills at the 5% significance level.

CALCULATE THE DIFFERENCES BETWEEN THE 2 TREATMENTS:

Sub	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Pre	30	28	31	26	20	30	34	15	28	20	30	29	31	29	34	20	26	25	31	29
Post	29	30	32	30	16	25	31	18	33	25	32	28	34	32	32	27	28	29	32	32
Dif	-1	2	1	4	-4	-5	-3	3	5	5	2	-1	3	3	-2	7	2	4	1	3

P) STATE POPULATION PARAMETER:

μ = the mean improvement in listening scores for teachers attending the institute (Post – Pre)

H) STATE HYPOTHESES:

$H_0 : \mu = 0$ $H_a : \mu > 0$

A) VERIFY CONDITIONS REQUIRED FOR TEST:

a) Random

Unknown; we may not be able to generalize the results to all teachers attending the institute!

b) Normal sampling distribution- normal population or large sample size ($n > 30$) or justification for normal distribution ($n < 30$) after omitting outliers

Since the sample size is small, put data (differences) into list and check:

a) modified box plot… indicates no outliers

b) normal probability plot indicates a normal distribution (a histogram shows a slight skew).

c) Independence

$N > 10n > 10(20) > 200$ Spanish teachers attending institute… probably?

T) PERFORM TEST:

a) USING TABLE B:

i) Determine mean ($\bar{x}$) and standard deviation (s)

$\bar{x}$ = 1.45 s = 3.2032

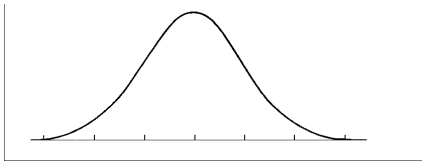
ii) Calculate *t* statistic

$$t = \frac{\bar{x} - 0}{\frac{s}{\sqrt{n}}} = 2.024$$

iii) Determine degrees of freedom

df = n – 1 = 20 – 1 = 19

iv) Determine critical *t*-value and *P*-value



From Table B (df = 19 and α = .05), the critical *t* value is 1.729.

Since 2.204 >1.729, *P*-value < .05.

b) USING CALCULATOR:

STAT ⟶ TESTS ⟶ T-Test… *P*-value = .029

DISTR ⟶: tcdf (min, max, df) = (2.024, 100, 19) = .0286

S) STATE CONCLUSION:

At α =.05 significance level, the study gives evidence that listening scores improved after the institute (*P*-value = .029) but the evidence is not overwhelming (since the results are not significant at α = .01) We, nonetheless, reject the null hypothesis.

CONFIDENCE INTERVAL (Use PAIS):

A 90% confidence interval for the mean increase in listening scores can be found using:

STAT ⟶ TESTS ⟶ T Interval = (.21, 2.69)

We are 90% confident that the mean increase in the listening scores was between .21 and 2.69 points after teachers participated in the institute.