

10.4 Matched or Paired Samples

Section 10.4 Matched or Paired Samples

Learning Objective:

In this section, you will:

- Apply hypothesis testing and calculate confidence intervals to real-world problems about the mean of two dependent samples (matched pairs)

When using a hypothesis test for matched or paired samples, the following characteristics should be present:

1. Simple random sampling is used.
2. Sample sizes are often small.
3. Two measurements (samples) are drawn from the same pair of individuals or objects.
4. Differences are calculated from the matched or paired samples.
5. The differences form the sample that is used for the hypothesis test.
6. Either the matched pairs have differences that come from a population that is normal or the number of differences is sufficiently large so that distribution of the sample mean of differences is approximately normal.

A hypothesis test for matched or paired samples

- Random Variable: \bar{x}_d = mean of the differences
- Distribution: Student's-t distribution with $n - 1$ degrees of freedom
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Example 1: A study was conducted to investigate the effectiveness of hypnotism in reducing pain. Results for randomly selected subjects are shown in the table below. A lower score indicates less pain. The "before" value is matched to an "after" value and the differences are calculated. The differences have a normal distribution. Are the sensory measurements, on average, lower after hypnotism? Test at a 5% significance level.

Subject	A	B	C	D	E	F	G	H
Before	6.6	6.5	9.0	10.3	11.3	8.1	6.3	11.6
After	6.8	2.4	7.4	8.5	8.1	6.1	3.4	2.0

First find the differences:

1. Null and Alternative Hypothesis
- 1
2. Calculator Work
3. Test Statistic and P-Value
4. Conclusion about the null hypothesis
5. Final conclusion that addresses the original claim
6. Test the above claim by constructing an appropriate confidence interval.

Example 2: Seven eighth graders at Kennedy Middle School measured how far they could push the shot-put with their dominant (writing) hand and their weaker (non-writing) hand. They thought that they could push equal distances with either hand. The data were collected and recorded in the table below.

Distance (in feet) using	Student 1	Student 2	Student 3	Student 4	Student 5	Student 6	Student 7
Dominant Hand	30	26	34	17	19	26	20

Weaker Hand	28	14	27	18	17	26	16
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Conduct a hypothesis test to determine whether the mean difference in distances between the children's dominant versus weaker hands is significant.

1. Null and Alternative Hypothesis
- 2
2. Calculator Work
3. Test Statistic and P-Value
4. Conclusion about the null hypothesis
5. Final conclusion that addresses the original claim
6. Test the above claim by constructing an appropriate confidence interval.

For more information and examples see online textbook OpenStax Introductory Statistics pages 584-590.

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