

t-Test Playground Challenges

Below I provide a few different challenges to help deepen your understanding of **statistical tests** and **effect size**. Use the [Inference Tests Scratchpad](#).

Using the Playgrounds

The activities for this scratchpad are organized around the **POE principal**. First **predict**, then **observe**, and finally, **explain**.

The purpose of the predict step is that you write down your predictions before entering data for a particular exercise. This step is extremely important: I do not want to encourage people to mindlessly input numbers until a correct solution is reached. Instead, I want to encourage you to actively think about the questions and make your best educated guess before starting to enter data. Observing the results of data entered based on your well thought out prediction builds a better stage for understanding where and when you have misconceptions.

More importantly, students should view using the Statistical Scratchpads as an iterative process. This means that you will enter some data, receive feedback, and then you can revise your data as often as necessary to meet the conditions stated in a particular problem. If your observation is very different from what you predicted, then you will have an important basis for re-evaluating and re-conceptualizing where and why your prediction was off base. The final step is to explain either the similarities between your prediction and subsequent observation OR to explain the dissimilarities.

The Activities

You are going to enter scores where gender (males and females) is the independent variable and “conceptual understanding of physics” is the dependent variable. “Conceptual understanding of physics” is measured on a 0–10 scale where 0 = low conceptual understanding to 10 = high conceptual understanding.

Use a blank piece of paper to write down a set of scores that you think might work based on your prediction. When you are happy with a draft set of scores, then enter them into either the web-based [Inference Tests Scratchpad](#).

t-Test Challenges

For the t-test challenges we will use gender as an independent variable. You have 6 male and 6 female scores on their **understanding of physics** test that is measured on a 0–10 scale.

Challenge 1

Create a situation where there is a moderate effect size difference favoring males, but the difference is **not** statistically significant according to the t-test.

1. **Predict:** Write a set of numbers that you think will generate this result.
2. **Observe:** Now put your numbers into the scratchpad. What do you observe?
3. **Explain:** Compare your predictions and observations. Explain the results.

Challenge 2

Create a situation where there is a large effect size difference favoring females and the difference is statistically significant according to the t-test.

1. **Predict:** Write a set of numbers that you think will generate this result.
2. **Observe:** Now put your numbers into the scratchpad. What do you observe?
3. **Explain:** Compare your predictions and observations. Explain the results.

Challenge 3

Create a situation where there is a small effect size difference favoring females.

1. **Predict:** Write a set of numbers that you think will generate this result.
2. **Observe:** Now put your numbers into the scratchpad. What do you observe?
3. **Explain:** Compare your predictions and observations. Explain the results.

Challenge 4

Create a situation where there is a large effect size difference favoring males but it is **not** statistically significant.

1. **Predict:** Write a set of numbers that you think will generate this result.
2. **Observe:** Now put your numbers into the scratchpad. What do you observe?
3. **Explain:** Compare your predictions and observations. Explain the results.