Math Objectives

- Students will describe how power is influenced (in predictable directions) by the sample size, alpha, and the true population mean.
- Students will describe how power relates to the decision making in a real-world scenario.

Vocabulary

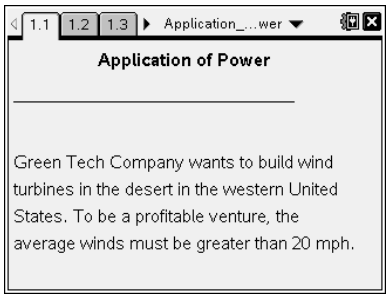
- alpha level
- power

About the Lesson

- This lesson is a follow-up lesson to the activity *Power.*
- By manipulating the sample size, the true population mean, and alpha, students recognize how each of these is related to power.
- As a result, students will:
  - Learn about the concept of power.
  - Relate the value of power to a real-world scenario.

TI-Nspire™ Navigator™

- Send .tns file to students.
- Use Quick Poll to determine student understanding.



TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Click a minimized slider

Tech Tips:

- Make sure the font size on your TI-Nspire handhelds is set to Medium.

Lesson Materials:

Student Activity

Application_of_Power_Student.pdf

Application_of_Power_Student.doc

TI-Nspire document

Application_of_Power.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Teacher Tip: Students should understand the concepts of power and type II error before starting the activity.

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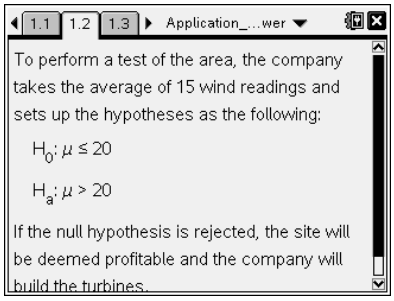

1. a. What does the power of the test represent in terms of the hypotheses?

   Sample Answer: the probability that the test will reject the null hypothesis when the alternative hypothesis is true

   b. What does the power of the test represent in terms of the company's decision for the site?

   Sample Answer: the probability that the test will suggest that the average wind velocity is greater than 20 mph and the site is feasible to build on

2. When the company tests the site, would they want power to be closer to 1 or 0? Explain your reasoning.

   Sample Answer: They would want a value closer to 1 because it would mean a greater probability of the null hypothesis being rejected when the alternative hypothesis is true and, therefore, a greater probability of the site being accepted when the true wind velocity average is greater than 20 mph.

Teacher Tip: Discuss with students that a high power value also decreases the probability of a type II error, or not rejecting the null hypothesis when the alternative hypothesis is true. In this scenario, a type II error would mean rejecting the site when the true wind velocity average is greater than 20 mph.

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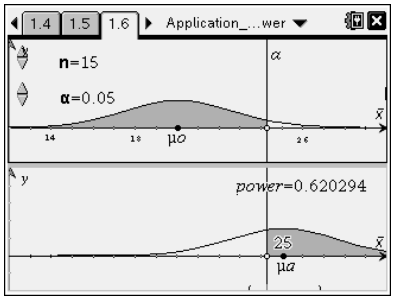

Click the arrows of the sliders to change **n** and **α**, where *n* represents the number of readings and α is the alpha level.

3. a. How can you adjust **n** and **α** to get the best power value?

   Sample Answer: Increasing both *n* and α will increase the power value.

TI-Nspire Navigator Opportunity: *Quick Poll*
See Note 1 at the end of this lesson.

Teacher Tip: Explain to students that they should be cautious about increasing the alpha level because that will increase the probability of a type I error, or rejecting the null hypothesis when it is true. In this scenario, this would mean accepting the site though the wind velocity average is actually equal to or less than 20 mph, indicating a nonprofitable site.

Teacher Tip: Students may have to click in a white space on the bottom graph to make the shading for the power region show up.

4. Drag the point labeled **μa** to change the true wind average.
   a. What do you notice? Why do you think this happens?

Sample Answer: Increasing or decreasing the true average changes the power. If the true average is closer to the null hypothesis, there is more of a chance that the sample mean will not fall in the rejection region for the test. If the true average is farther away from the null hypothesis, there is more of a chance that the sample mean will fall in the rejection region for the test.

   b. Explain what this means in terms of the probability of determining whether the site is profitable to build on.

Sample Answer: When the true wind average of the site is closer to the null hypothesis, then there is a lower probability that the site will be determined to be profitable even though it meets the requirements. When the true wind average of the site is farther away from the null hypothesis, there is a higher probability that the site will be determined to be profitable when it indeed does meet the requirements.

Teacher Tip: In practice, the true population mean is not known. (If it were known, there would be no need for a hypothesis test!) So, calculating "the" power of a test is impossible. After all, the value of power depends on the actual difference between the hypothesized mean and the true mean. Thus, it is more correct to talk about the power of a test "against μ_a," that is, against a specific alternative, which may or may not be the true mean. In practice, μ_a would be selected as a threshold value for what the experimenter would deem to be a contextually important difference.

Wrap Up

Upon completion of this activity, students should understand:

- How power is influenced (in predictable directions) by the sample size, alpha, and the actual mean.
- How the probability of power affects the decision in a real-world scenario.

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Note 1

Question 3a, Quick Poll:

1. To increase power, how should you change *n* and α?
   a. increase *n* and decrease α
   b. decrease *n* and increase α
   c. increase *n* and increase α
   d. decrease *n* and decrease α

Correct answer: c