NIMBioS Activities Connecting Math and Science in Middle School

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Teacher and Student Workshops

Biology in a Box

- Hands-on, inquiry-based curriculum enrichment units for K-12
- Math and biology together

“Yes, this will be useful to you later in life.”
Undergraduate Programs

- Undergraduate Research Conference (annual in fall)
- Summer Research Experiences for Undergraduates and Teachers
The importance of random sampling
Goals:

• Demonstrate understanding of random and nonrandom sampling

• Discuss importance of random sampling

• Recall how to find mean/average, median, mode, range, and apply to data

• Use measures of central tendency to compare datasets
What is random sampling?

• Random sampling is a way to remove bias in a sample selection, and it tends to produce representative samples of a larger population.

• When is random sampling used?

• What happens when a personal or nonrandom selection happens instead of a random sample?
Circle Activity

• Step 1: Number the circles from 1 to 80.

• Step 2: Take 15 seconds and select five circles to use to estimate the average diameter of the 80 circles.
Circle Activity

• Step 3: Find the diameter (in cm) for each circle.
• Step 4: Find the average diameter. Make sure to show your work.
• Example:

  \[2+1+2+3+3=11\]
  \[11/5=2.2\]

  Average Diameter: 2.2 cm
Circle Activity

- Step 5: Find the average diameter for the class.
- Example:
  - John’s average diameter: 1.6 cm
  - Your average diameter: 2.2 cm
  - Sheri’s average diameter: 1.8 cm
  - Sam’s average diameter: 1.4 cm
  - Their average diameter: 1.75 cm
Circle Activity

- Step 6: Use random number generator to pick 5 circles and find their diameters.

- Step 7: Find the average diameter of the random sample of circles.

- Step 8: Find the average diameter of the random sample of circles for the whole class.
Circle Activity

• Step 9: Find the median, mode, and range of the class’ choice of circles and the class’ random sample of circles. Then compare the median, mode, range, and mean/average.

• Step 10: Describe and compare the class’ mean diameter of their choice circles and the randomly selected circles.
Circle Activity

• The true average diameter is 1.25cm.

• Step 11: How is the true average different than your personal selection and your random sample mean diameter? Why?

• Step 12: What is bias? How did it appear in your personal selection? How does random selection help eliminate bias?
Biology Meets Math

MEASURING A FOREST
Goals

• Be able to describe the area and distribution of forests in the United States
• Understand why it is important to measure and monitor forests
• Define terms: biomass, crown, dendrologist, DBH
• Find out what \( \pi \) has to do with measuring a tree
• Define and calculate stand density
Area of Forests in US

- In 2010, there were 304,022,000 ha of forest in the United States.
- The United States is 982,667,500 ha.
- What percent of the United States’ area is forested?

\[
\frac{Part}{Whole} \times 100\% = \frac{304,022,000}{982,667,500} \times 100\% = 
\]
How do we measure something so big?
What is **DBH**?

**Diameter at Breast Height**

- Diameter of the tree 4.5 feet above forest floor on the uphill side
- Avoids the swell at the base of the trunk
How can you use circumference to find diameter?

\[ C = \pi D \]

\[ C/\pi = D \]

Let’s Practice!
Problem & Solution

- You are a forester collecting tree DBH data
- You’d rather not bring a calculator into the field with you
- Can you invent something that, if you use it to measure the circumference, it automatically gives you the diameter?
- Discuss DBH tape measure.
Make Your Own DBH Tape

- Mark off every pi (3.14) inches
- What is 0.14 of an inch?
- Somewhere in between 1/8” and 3/16”
- Test it out!
A Forest is Many Trees

Chequamegon National Forest, WI

Mendocino Pygmy Forest, CA

How to describe the difference with numbers?
Stand Density

1. Count the number of trees (10)
2. Find the area (L*W) of the stand (15 ft * 25 ft = 375 ft²)
3. Divide the numerator by the denominator (10/375 = 0.03 trees/ft²)

Stand Density = \( \frac{\text{number of trees}}{\text{area of stand}} \)
A “Forest” of Humans

If the people in this classroom were trees, and this classroom were our plot …

What would be our stand density?
Sources


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