POGIL-STYLE ACTIVITIES IN INTRODUCTORY STATISTICS

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INTRODUCTION
FOUR NEW LEARNING ACTIVITIES
• Applies recommendations from the original GAISE College Report and GAISE 2016
  • Teach statistical thinking
  • Teach statistics as an investigative process of problem solving and decision making
  • Give students experience with multivariable thinking
  • Focus on conceptual understanding
• Integrate real data with a context and purpose
• Foster active learning
• Use technology to explore concepts and analyze data
• Use assessments to improve and evaluate student learning

INSPIRED BY RESEARCH
• POGIL – Process Oriented Guided Inquiry Learning

• Statistical Education Research shows students struggle with terms and concepts
  • “random” and “confidence” (Kaplan, Fisher and Rogness, 2009)
  • Understanding histograms (Kaplan, Gabrosek, Curtis, and Malone, 2014)
  • Sampling distributions (Chance, DelMas, and Garfield, 2004)
THE SETUP - FINGERPRINTING

• Each person has a unique fingerprint.
• If we look at the fingerprint of the thumb, there are three common characteristics: loops (lines that bend back on themselves), whorls (such as circles or ellipses) and arches (wave-like patterns).
• In the United States, 60% of the population has loops, 35% whorls, and 5% arches.
• In the bin of beads, each bead represents an individual with a certain type of pattern on their thumb: White for loops, Yellow for whorls, and Black for arches.

ACTIVITY ONE

Investigation Questions
• If you were to take a random sample of American adults, would the sample proportion of individuals with whorls change from sample to sample; if so by how much?
• What are typical values of the sample proportion?

ACTIVITY TWO

Investigative Question
• What are the center, shape, variability, and outliers of the distribution of loops, whorls, and arches for different sample sizes?
ACTIVITY THREE

Investigative Questions

• What is the sampling distribution of the sample proportion of fingerprints with loops for \( n = 40 \) and \( n = 100 \)?
• How do the mean, standard deviation, and shape for sampling distributions change as sample size is increased?
• What is the difference between the population distribution, sample distribution, and sampling distribution?

ACTIVITY FOUR

Investigative Questions

• What is a reasonable estimate for the population parameter?
• Why is a confidence interval a better estimate than a sample statistic for the population parameter?
• Will a confidence interval always contain the true population parameter?
• What are margin of error and standard error?

NOW, ITS YOUR TURN.
EARLY RESULTS
WHAT DID WE LEARN ABOUT THE STUDENTS?

COMPARISON OF LEARNING GAINS
PRE ASSESSMENT
<table>
<thead>
<tr>
<th>Percent (n = 41)</th>
<th>POST ASSESSMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Center</td>
<td>Center</td>
</tr>
<tr>
<td>Min</td>
<td>Min</td>
</tr>
<tr>
<td>Max</td>
<td>Max</td>
</tr>
<tr>
<td>Range</td>
<td>Range</td>
</tr>
<tr>
<td>Outliers</td>
<td>Outliers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bell Shaped only</th>
<th>Right Skewed only</th>
<th>Unimodal only</th>
<th>Both</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.7%</td>
<td>4.9%</td>
<td>18.6%</td>
<td>14.2%</td>
</tr>
</tbody>
</table>
STUDENT BELIEFS ABOUT ACTIVITY TWO

Engaging / Enjoyment

- Very much
- Somewhat
- To a very limited degree
- Not at all

Waste of Time / More Bored than Usual

- Strongly agree
- Agree
- Disagree
- Strongly disagree

How engaging did you find the activity?
How much did you enjoy the activity?

STUDENT SELF ASSESSMENT OF MATERIAL BEFORE AND AFTER THE ACTIVITY

CENTER

Grade for Understanding

SHAPE

Grade for Understanding

VARIABILITY

OUTLIERS

Grade for Understanding

Grade for Understanding

Grade for Understanding

Grade for Understanding

Grade for Understanding
UNIT EXAM EXEMPLARS #1

UNIT EXAM EXEMPLARS #2

REFERENCES


REFERENCES (CONT’D)


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