Best Practices to Engage AP Statistics Students

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1. Using previous AP free response student responses to help students improve.
   Go to collegeboard.com to view the free response questions. Each of these questions have sample student responses along with their scores. Choose two papers on the same question. Go over the rubric with the students and have them score each paper. Then reveal the sample student response scores.

   Ex: 2014 – question 4

2. Cents and the Central Limit Theorem
   This lab requires lots of pennies. I collected them over time. You may also ask your students to each bring in 25 or 50 pennies each and return their pennies to them when the lab is finished.

3. Type I and Type II Error – a visual approach

4. Will You Be Mine lab.
   This lab can be used for a 1 proportion z-test. In addition, you could adapt it for a 2 proportion z-test or a chi-square test.

5. How long is a minute? (t-test; mean of differences; values are not independent).

CENTS AND THE CENTRAL LIMIT THEOREM

1. Get 25 pennies, and list the dates. Next to each date, write the age of the penny by subtracting the date from the current year. What do you think the shape of the distribution of all the ages of the pennies from students in your class will look like?

2. Make a histogram of the ages of all the pennies in the class.

3. Estimate the mean and the standard deviation of the distribution. Confirm these estimates by actual computation.

4. Take a random sample of size 5 from the age of your pennies, and compute the mean age of your sample. Three or four students in your class should place these sample means on a number line.

5. Do you think the mean of the values in this histogram (one it is completed) will be larger than, smaller than, or the same size as the one for the population of all pennies? Regardless of which you choose, try to make an argument to support each choice. Estimate what the standard deviation of this distribution will be.

6. Complete the histogram, and determine its mean and standard deviation. Which of the three choices in 5 appears to be correct?

7. Repeat this experiment for samples of size 10 and size 25.

8. Look at the four histograms that your class has constructed. What can you say about the shape of the histogram as n increases? What can you say about the center of the histogram as n increases? What can you say about the spread of the histogram as n increases?

TYPE 1 AND TYPE II ERROR

Make a chart to determine if the error is Type I, Type II or a Correct Decision. Complete the chart and highlight or circle the correct columns. Be sure to state your answer below the chart.

1. A test is made of H_0: $\mu = 37$ vs. H_a: $\mu < 37$. The true value of μ is 37 and H_0 is rejected. What type of error if any is made?

		TRUTH about the population	
Decision			

2. A test is made of H_0: $\mu = 112$ vs. H_a: $\mu \neq 112$. The true value of μ is 100 and H_0 is rejected. What type of error if any is made?

		TRUTH about the population	
Decision			

3. A doctor believes that the mean number of days per year her patients are sick is less than 10 days. A test is made of H_0: $\mu = 10$ vs. H_a: $\mu < 10$. The null hypothesis is not rejected. The true number of days sick was found to be 9 days. State an appropriate conclusion.

		TRUTH about the population	
Decision			

4. A test of H_0: $\mu = 225$ vs. H_a: $\mu > 225$ is performed using a significance level of $\alpha = 0.01$. The value of the test statistic is z = 2.4251.
   a. What is the p-value for this problem?
   b. Is H_0 rejected or do you fail to reject?
   c. If the true value of μ is 227, is the result a Type I error, a Type II error or a correct decision? (make a chart for this part of the problem).

		TRUTH about the population	
Decision			

WILL YOU BE MINE ?

Supplies:1 scoop of conversation hearts per person (about 50)

1. Do not eat the hearts until this activity is complete. Separate the hearts by color. Count and record how many of each color and your total sample size.

2. What proportion of hearts are pink in your sample?

3. Do you know the proportion of pink hearts in the original population?

4. Did everyone in the class obtain the same proportion of pink hearts?

5. Find the mean of the proportions of the class. (You may do this using Navigator to get the data.)

6. If you wanted to predict the true proportion of pink hearts manufactured, what could you do to increase the accuracy of your prediction?

7. Suppose each person in the school calculated a 95% confidence interval (if they knew how!). What percentage of the confidence intervals would you expect to contain the true proportion of pink hearts?

8. What type of distribution is described by counting how many hearts are pink and how many are not pink, in a given sample?

9. a. If n is large, what distribution does a binomial distribution represent?

b. How big must n be so that you can use this approximation? (pg 687)

c. Were you provided with a sample large enough to make this approximation? Base your answer of the mean of the proportions of the class. How big a sample size would be needed?

10. Find the standard deviation for a proportion from a binomial distribution. Perform the calculation based on your sample.

11. Find a 95% Confidence Interval for the true proportion of pink hearts in the population of conversation hearts. Use your sample.

How Long is a Minute?

This is a classroom activity that can be done to start to discuss paired data.

1. Each student should have a partner and sit as far as possible from other students in the class. Make sure the clock is covered up in your room. Also, students who wear watches should remove them.

2. Take turns timing and measuring. The timer says when to begin, and the "player" tells the timer when he/she believes a minute has passed. Quietly say stop or create a signal to indicate to stop the clock! Switch roles. Each student should complete the measurement twice.

3. Have students send in(TI-Navigator) or write on the board their first estimate, second estimate and mean of their estimates.

4. Have students perform a paired sample t-test on the data from the class.

5. As an extension, randomly assign partners. Conduct a test using the 2 sample independent t-test. This would require a second set of data in which a chart is created with Student 1 and Student 2 where each records his/her time.