The Sum of Independent Normals Is Normal

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My approach to teaching statistics is to use the activity based approach. I usually start class by performing an experiment illustrating the ideas we have studied. Then I discuss a new idea, say confidence intervals, and I finish off by performing another experiment that illustrates the new concept. I use the TI 83. Each student in the class has one. I don't require it, but I strongly recommend it. This is sufficient.

I like the activity based approach because I learned a long time ago that students feel more comfortable when they gather data themselves and analyze it. This is a good way to get students involved in the course. As the following Chinese proverb states: I hear, and I forget. I see, and I remember. I do, and I understand.

I introduce the normal distribution by means of in class experiments. For example, I have the students take their pulse and we do a histogram of the data. It is usually bell shaped. I also have a quincunx that vividly demonstrates that the binomial distribution can be approximated by the normal distribution.

I introduce the central limit theorem in two ways. I use the TI 83 to calculate a lot of means by sampling from a uniform distribution, say the numbers, 1 through 20. We then graph these sample means on the TI 83 and they are usually bell shaped. Another way to do it is by means of an urn and numbered discs. I construct one hundred discs that follow the Chi Square Distribution. We then sample from the urn and construct about thirty sample means. The result will be the normal distribution.

I am enclosing a summary of experiments that I do in class. I hope they will be useful.

l. Experiment: Deming Beads
Objective: The students will understand that a random sample mimics an entire population.

2. Experiment: Average Height Experiment
Objective: The students will learn how to select a random sample from a class of 30 students.

3. Experiment: Random Rectangles
Objective: The students will be able to draw a stratified random sample.

4. Experiment: Babe Ruth vs. Mark McGuire
Objective: The students will be able to compare two samples by means of a stem and leaf plot.

5. The water drop experiment.
Objective: The students will estimate the number of water drops that a nickel will hold by means of a dot plot. The student will learn that there is usually variability in data.

6. Experiment: The Birthday Problem I
Objective: The student will be able to understand the difference between categorical data and quantitative data.

7. Experiment: The Scatter Plot Experiment

Objective: The students will plot and analyze two variables at once. This is an example of bivariate data.

8. Experiment: Dice
   Objective: The student will be introduced to the meaning of probability.
9. Experiment: Card Experiment I
   Objective: The students will be able to randomize before starting and experiment and then how to calculate the probability when the word **or** is involved.
10. Experiment: Card Experiment II
    Objective: The students will learn how to sample with replacement and calculate probabilities.
11. Experiment: Card Experiment III
    Objective: The students will learn how to calculate conditional probabilities.
12. Experiment: The Meteor Problem
    Objective: The students will be able to do a probability problem by means of simulation.
13. Experiment: Advanced Quincunx
    Objective: The student will understand how the normal curve approximates the Binomial Distribution and how increasing the variability in the experiment changes the normal curve.
14. Experiment: The Capture Recapture Problem
    Objective: The students will be able to estimate the number of fish in a lake.
15. Experiment: What is the most popular letter in the alphabet?
    Objective: The students will be able to analyze categorical data and determine which letter is most used in the English alphabet.
16. Experiment: Birthday Problem II
    Objective: The students will be able to calculate the probability of an event by calculating the probability of the complement of the event.
17. Experiment: The Monte Hall Problem
    Objective: The students will solve a difficult problem by means of simulation.
18. Experiment: The Helicopter Experiment
    Objective: The students will model a physical problem by means of linear regression.
19. Experiment: The Catapult
    Objective: The students will model the distance a catapult can throw a ball by means of linear regression.