A Thousand Cranes and Statistics

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Abstract

The origami crane has become a symbol of peace since stories of Sadako and the thousand cranes have been told after the atomic bombing of Hiroshima. How long does it take to make 1000 cranes? I used this topic to bridge my literature unit to a statistics unit in my general education mathematics class. I taught the class how to make a paper crane, then I had the students time themselves while they made another crane. Descriptive statistics can be introduced by using the times measured in class. Inferential statistics can then be introduced by using these times as a sample, and we can estimate how long it would take a person to make 1000 cranes.

Sadako was a two-year-old girl in Japan when the atom bomb was dropped on Hiroshima, Japan, on August 6, 1945. As she grew up, she was a strong, courageous, and athletic girl. In 1955 she entered a race, but after the race she got dizzy and fell to the ground. She was diagnosed with leukemia (a common disease caused by the atomic bomb). She lay very ill, and a girl friend of hers reminded her of the Japanese legend that if a sick person folded 1000 paper cranes, the gods would grant her a wish and she could be well. The paper crane was a symbol of good luck. Unfortunately, Sadako died before she reached her goal; she was able to fold 644 cranes before she died. Her friends knew about her goal and continued to make the cranes until there were one thousand of them. Stories have been written about her, and the paper crane has been known as the symbol of "peace" throughout the world. In 1958 a statue of Sadako holding a golden crane was unveiled in Hiroshima Peace Park. There is also a memorial statue in Seattle. People all over the world send paper cranes to these monuments. Now chains of a thousand cranes are also used as decorations at weddings and funerals.

So how long does it take to make a thousand cranes? I had my mathematics classes learn to make the cranes, then we had an introduction to statistics using the example of making cranes. It was a nice way to bridge the gap between our "mathematics in literature" topics and statistics topics for this general education mathematics class (math for non-science majors). Topics of history and culture could also be included for elementary students.

Nearly every origami book has the instructions of how to make a paper crane; it is one of the most popular origami forms. There are several sites on the Internet with instructions. One site with a one-page instruction sheet is http://www.wbu.com/edu/brochures/WhoopingCraneOrigami.pdf. Origami starts with an exact square of paper. As the initial basic triangular folds are made, the students can be taught how to make sure the paper is square. As folds are made, students can recognize geometry and symmetry along with calculating the sizes of angles in the triangles.

After all the students knew how to make the crane, I had them time themselves for the next two cranes they made and write down the times. I gathered the times and put them into a spreadsheet or calculator. Times were written in minutes and seconds, so we converted all times to decimal minutes rounded to the tenth of a minute (for simplicity). Only a few students in the class had the scientific calculators that do

statistics, and only a few students had ever used a spreadsheet, so I just briefly described how to sort the data and get statistics. With the list of times, I had the students do a quick stem-and-leaf plot then an ordered stem-and-leaf plot to sort the numbers.

The students identified some of the basic descriptive statistics using this data: Minimum, maximum, range, mean, median, mode, and quartiles. We sketched a simplified box plot for the data. We also sketched a histogram. One could also do relative frequency charts and histograms with different class widths, frequency polygons, and ogives, but I was teaching a general education class and just wanted to highlight the basics.

Since I also teach statistics, I briefly told them what would be covered in the statistics course and what descriptive and inferential statistics topics are. Without giving the class the theory, I described to the students sampling and confidence intervals and gave them a 95% confidence interval of the time it would take one student to make one crane, based on their sample. We discussed warnings and limitations of using inferential statistics to determine the time for one person to make 1000 cranes.

We reviewed unit conversion with minutes, hours, days, and years.

For the workshop, we will make a paper crane. Using a sample of times, we will do the descriptive statistical calculations.

Minimum: shortest time
Maximum: longest time
Range: Maximum - minimum
N: number of items
Mean: (average) Sum of measurements divided by number of items
Median: Middle number of sorted list
Mode: Most often occurring time
Q1 and Q3: quartiles (median of median)
Stem-and-leaf plot
Ordered stem-and-leaf plot
Simplified box plot
Histogram

In reality, estimation would use a random sample of times to make the crane after the learning process is complete and the time is constant. For the students in the class the times should get shorter each time a crane is made until the student is proficient, and then the time to make one crane is approximately constant. In the classroom, we had to use times while the students were still learning to make the cranes efficiently.