Geometry Origami Similarity Project

The ancient art of paper folding is called origami. Origami can transform a flat piece of paper into beautiful figures, like the paper crane. Today, we are going to use origami and paper folding skills to make paper cups, then analyze and compare them mathematically to relate to the concept of similarity. We will be working as a class, so please follow along with your teacher!

Investigation 1: Linear Scaling

Each student will be given a six-inch and twelve-inch square of paper. Without folding it, compare the two shapes. Answer the following questions:

1. How are the squares alike?

2. How are the squares different?

Your teacher will now walk you through the steps to fold your first paper cup. Please listen carefully to your teacher! Once your cup is completed, answer the following questions:

3. Measure and record the width of the top and bottom of the twelve-inch cup.

4. What is the ratio of the side length of the square to the width of the top of the cup?
5. Using your ratio from #4, predict the width of a cup made with the six-inch paper.

Now, test your prediction by folding and measuring the six-inch cup. Please let your teacher know if you forget the origami directions!

6. Was your prediction accurate? Why or why not?

7. Use your new knowledge of scaling to predict the width of a cup made from a four-inch square? The height? The length of the diagonals?

8. Based on your observations in this investigation (as well as your notes from class), when given proportional figures, what relationship exists between corresponding lengths?

Investigation 2: Scaling Up a Cup to be a Hat

For this investigation, you will need a partner. Decide who wants to be the "model" and who wants to be the "tailor". Again, please follow along with your teacher!

9. How large a piece of paper is needed to make a hat that would fit your model's head? Write your prediction below and why/how your arrived at those measurements.
Using your measurements you predicted in #9, cut out your square from the large paper your teacher has provided and begin folding your hat. Feel free to decorate you hat!!!

10. Did your hat fit your model?? Explain why or why not? If you had to begin again, would you do anything different?

Investigation 3: Comparing Volumes of Similar Cups

Stay with your partner for this investigation. Go back to your six-inch and twelve-inch origami cups. Look inside the cups.

11. How many little origami cups are needed to fill the big origami cup?

12. Explain how your arrived at your answer to #11.

Each pair of students will be given a bowl of popcorn kernels. Using your smaller origami cup, fill the big (twelve-inch) cup up with kernels.

13. How many little cups did it take? Was your prediction correct? Why or why not?

14. From what you observed in this investigation, what would you say is the ratio of volumes from the small to big origami cups?
15. How many four-inch cups would be needed to fill a 12-inch cup? (Hint: You found this scale factor in Investigation 1).

Bonus Question: What would be the ratio of volumes of the four-inch cup to the six-inch cup?

When you have answered all the questions, please clean up your desks and return the popcorn kernels to your teacher. (Make sure they are all picked up off the floor!) Thank you.