



How Big is Barbie?

Submitted by Greg Rhodes, Trabuco Hills High School, CA

In this activity students will measure various dimensions of a male and a female doll's body and scale them proportionally to average human measurements. They must calculate the appropriate scale factor (magnitude) to enlarge their doll and apply that scale factor to enlarge the other measurements. Once completed, the students will analyze and describe the enlargements, as well as explore the commercial and social implications of the dolls' designs.

LESSON PLAN

Have students work with a partner or in groups. Instruct them to take the following measurements of both Barbie™ and one male action figure: height, head (circumference), chest, waist, inseam, and foot (length). The measurements are written in the first blank column of each of the charts. The numbers already given in the chart are the average measurements for females and males. The students will use these numbers to calculate their size change magnitudes.

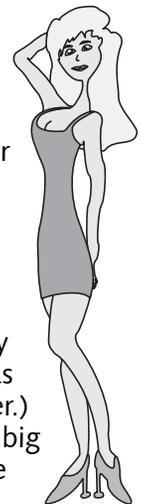
Once students have completed the measurements, walk them through the first conversion, using height to be the first standard. For example, if Barbie is 12 inches tall and the average woman is 65 inches tall, what would the other enlarged measurements be? Divide 65 by 12, to get a ratio of 5.6, then multiply each of the measurements by this ratio. Emphasize that this represents one "possible" body shape. The next conversion will use 21 inches as the standard for the head. Calculate this new ratio and repeat the process. This represents another "possible" body shape.

After the walk through, allow the students to complete the chart by calculating the conversions for the other standards. Reinforce that each column is one possible enlargement of the doll and that the body shape enlargements will not always come out looking the same.

To conclude the activity, the students should summarize their findings, and make conjectures in regards to why manufacturers chose the particular proportions of the dolls. There are four questions on the handout to guide the students in their analysis.

TEACHER COMMENTS

- Stress that each column in the chart is considered a different enlargement. Emphasize that for #1, you might be enlarging the doll to an average height, but for #2 you are enlarging the doll to an average head.
- It is helpful to model an example of the lab before the students begin. With a doll and tape measure, show them how to measure the doll's attributes, fill in the chart, calculate the magnitude, and enlarge all the measurements.
- The primary concept here is ratio and proportion, which can be dramatically demonstrated by comparing the bodies represented in each column. For example, at average height, Barbie has a large head with small feet, which means she cannot stand. (She could not at doll size, either.) Given an average foot size, her height is gargantuan, as is her head, yet her feet still are not big enough to support her. This is because each attribute of her body was multiplied by the same ratio; in other words, each body enlargement is proportional to the others.



Concepts

Ratios, proportions, similarity, measurement, Fundamental Theory of Similarity (optional)

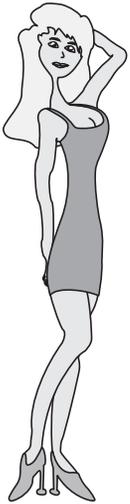
Time: 1-2 days

Materials

An assortment of Barbie dolls and action figures (Batman™, G.I. Joe™, Power Rangers™, etc.) Student Handout

Preparation

Tell the students in advance to bring dolls and action figures on the day of the lab. It helps to offer an incentive for the students (extra credit, etc.) Each group will need one male and one female doll. It will be helpful to have extras on hand.



How Big is Barbie?

If Barbie™ was the size of an average woman and Batman™ an average man, what would they look like?



First, find two dolls or action figures (one male, one female) and measure various attributes of their bodies (see charts below). Second, calculate an appropriate scale factor to enlarge a certain dimension to a certain size. For example, in the chart below, the height of the average male is listed as 72 inches. After you measure your male doll, multiply the figure's measurements by some factor in order to enlarge it to 72 inches. Then use that scale factor to determine the other enlarged measurements. You will perform this process several times for each figure. The numbers provided are the hypothetical average measurements for females and males.

DATA CHARTS

MALE	Doll	Height	Head	Chest	Waist	Inseam	Foot
Ratio							
Height		72"					
Head			23"				
Chest				40"			
Waist					32"		
Inseam						32"	
Foot							11"

FEMALE	Doll	Height	Head	Chest	Waist	Inseam	Foot
Ratio							
Height		65"					
Head			21"				
Chest				36"			
Waist					24"		
Inseam						30"	
Foot							9"

Remember: Each column represents a different possible enlargement of the doll. Look for their distinct characteristics. What makes one different from another?

ASSIGNMENT

Once you have the chart completed, answer the following questions about your data:

1. What are your initial impressions as you look at your results?
2. What would the figures look like if they were real people? Describe each possibility in detail.
3. How do the female's measurements in the height column compare to those in the foot column?
4. Why do you think the figures are designed with such measurements? Do these designs have social impact?

Extra Credit

Option #1: Take measurements of yourself and scale them backwards (reduce them) to determine the dimensions of a doll or action figure modeled after you. Write a paragraph describing what you would look like as a doll. You may also draw a picture to illustrate.

Option #2: Using the given measurements in one of the charts as the "average" male or female, scale the measurements backwards (reduce them) to determine the dimensions of a 12-inch doll or action figure with proportional measurements. Then compare the doll with your original doll's measurements and write a paragraph explaining the similarities and differences.