

SciGirls Activity 10

Tug-of-War



Icebreaker

Discover how to build a paper bridge with surprising strength!



You'll need:

- several kitchen recipe cards
- 2 stacks of books
- 30 pennies, or more!

SciGirls Skill: Predicting

Guide your girls as they

- 1) Make 2 equal stacks of books.
- 2) Lay 1 index card over the gap between the books.
- 3) Count the number of pennies you can put on the bridge before it collapses.
- 4) Now try using a folded card. Put accordion folds in the long direction of the card. Again, stack pennies on the folded card until it collapses.
- 5) Look for a relationship between the number of folds and the number of pennies the card can hold.



SciGirls Suggestion: Make this activity more than just a party trick by introducing the graphing skills suggested in Step 5 of the procedure. Put the number of folds along the x-axis and the maximum number of pennies held along the y-axis of a scatter plot.



Find out more about this investigation at pbskidsgo.org/dragonflytv/superdoit/filecardbridge.html

Investigation

Tug-of-War

We're Mattie and Sophie, and we head to camp every summer. We love to canoe, hike, and best of all, play tug-of-war. It's a big deal at our camp! We decided to use science to figure out a new strategy for winning. We wanted to know: When we form our tug-of-war team, should we use a few big kids or lots of smaller kids?



Working with groups of 6-10 girls, you'll need:

- sand bags, 50 lb. each
- a plastic snow sled, with large diameter rope attached
- a flat grassy surface outdoors
- a 50' tape measure
- cones or markers
- a stopwatch
- a bathroom scale



Find out more about Mattie and Sophie's investigation at pbskidsgo.org/dragonflytv/show/tugowar.html



Check out this investigation on the SciGirls DVD. Select "Tug-of-War" from the main menu.



SciGirls Want to Know

When we form our tug-of-war team, should we use a few big kids or lots of smaller kids?

Guide your girls as they

- 1) Have each girl stand on the bathroom scale. In a list, record the weight of each girl.
- 2) Decide upon a target team weight. This depends upon the sizes of the girls and the number of girls present. Younger girls (average weight around 80 lb.) select a team weight around 400 lb. Older girls (average weight around 110 lb.) select a team weight of around 500 lb.
- 3) Select a team of girls with a combined body weight close to the team target weight. Out of the pool of girls present, select as many smaller girls as possible to maximize the number of team members without exceeding the target weight.
- 4) Set sand bags in the snow sled to match the team weight. (Eight 50 lb. bags for 400 lb., for example.)
 - 5) Measure a distance of about 30 feet (about 9 meters), starting from the front edge of the sled. Use a cone or marker to indicate 30 feet.
 - 6) Have the first team of girls line up along the rope, then use the stopwatch to determine how long it takes the girls to pull the sled 30 feet.
 - 7) Assemble a new team of larger girls, hence with fewer team members. Again, target the same team weight, as closely as possible. Have that team pull the sled 30 feet, also recording the time. After resting, each team may make a second and third pull, if desired.



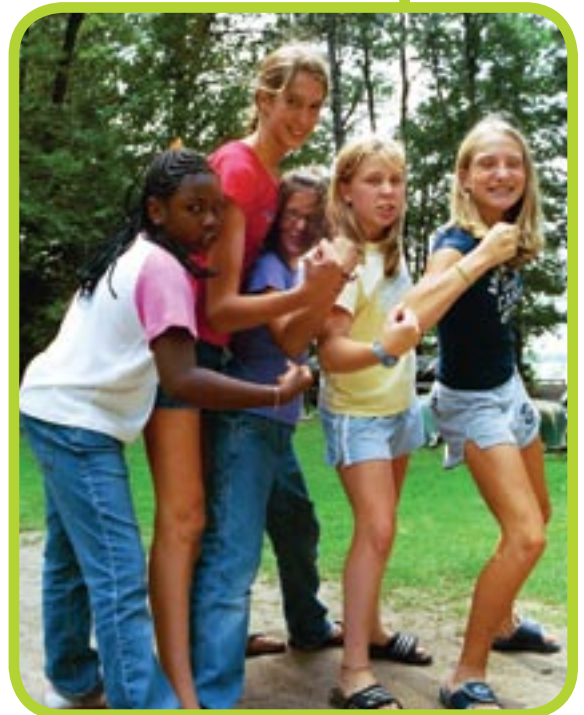
SciGirls Secret

There are a lot of factors that can influence the outcome of this investigation, such as the type of shoes the girls wear and the girls' strength. Use this investigation to get girls thinking about these contributing factors, and let them explore how different factors might play into the final result.



SciGirls Synthesize Data and Analysis

Determine an average pull time for each team. Compare the results, but take into consideration the range of times in the individual trials. In other words, if one team has an average time of 6.2 seconds while the other team has an average of 6.3 seconds, is the difference in these results significant?



Keep Exploring!

Discuss other strategies which are popular in tug-of-war. For example, many players assume the heaviest member of their team should take the rear position on the rope. Develop an investigation to see if there is any merit to this popular belief.