

## Exploration 5

### Why Buildings Stand Up

All structures depend upon invisible forces to hold them together and to allow them to support extra weight. These exercises will help students see and feel these forces to better understand how and why a building stands up.

#### *Materials:*

- Volunteers
- A chair
- A notebook

#### *Objective:*

Using interactive exercises, students will demonstrate and discuss the inherent building forces of tension and compression.

#### *Standards:*

- Arts: NA-VA 4; NA-D 7
- English: NL-ENG 7
- Mathematics: NM-PROB.CONN 3
- Science: NS: 1, 2, 5, 7

#### *Procedures:*

- Ask 2 students to stand on opposite sides of a chair.
- Ask whether or not there are any invisible forces acting on the chair. (Gravity is an unseen force pulling down on the chair.)
- Have one student gently push the chair a few feet. What force created this motion? The push acted against the other force (gravity) and made it move. A pull will do the same in the opposite direction.
- Now ask students to face each other and push with equal pressure on opposite sides of the chair so it doesn't move. This is called "compression." Note that now there are two forces, but they are balanced, causing the chair to remain in place. Discuss how the chair is like a building and experiment with the compressive (pushing) forces when they are not equal.
- Ask all students to place their hands together, palm-to-palm, fingers pointing up, and press their hands together. They are now feeling "compression". Stress the "press" in "compression."
- Have each student sit on a chair. Ask them to think of the chair legs as the lower columns of a skyscraper. They are squeezed by

- the heavy weight above them. This squeezing force is called compression and allows the building (or chair) to stand up
- Now ask 2 students to face each other on opposite sides of the chair and pull on the chair with equal pressure. This is called "tension." If the students apply the same amount of force, the chair will remain in place. Discuss how the chair is like a building and experiment with the tension (pulling) forces when they are not equal.
  - Ask all students to turn their left palm up, their right palm down, clasp their curled fingers together, and pull! The force they are feeling is tension.
  - Have each student pick up a chair and hold it upside down by its legs. Place a notebook on the bottom of the seat. Ask the students to pretend that the chair seat is a roadway on a bridge and the notebook is a car. The weight of the roadway and all the cars traveling on it pull on the vertical elements in this suspension bridge. The cables (chair legs and arms) are in tension and allow the structure to stand up.

*Reinforcement Exercise:*

Have students build "human structures"; go to the following website to get started

[http://www.pbs.org/wgbh/buildingbig/educator/act\\_mini\\_dome.html](http://www.pbs.org/wgbh/buildingbig/educator/act_mini_dome.html)