The Balloon and the Bell Jar

(Reinforcement Activity)

Materials

- Large bell jar with solid base to which a "pressure pump" can be attached
- "Pressure pump" (more commonly known as "vacuum pump") or some device that can remove the air from the jar
- Two partially inflated balloons (same size)
- Petroleum jelly to use as a sealant between the jar and the base
- Masking tape

Background Information

This activity underscores how a balloon's shape and size are a result of a balance of pressure between the inside and the outside of the balloon, and highlights the importance of using a relational causal model to interpret what happens. To make the relationship obvious, we place the balloon in a bell jar. Using a pressure pump, we reduce the pressure of the air in the jar and observe the effects it has on the balloon. The balloon will expand due to the air pressure differential between the inside and the outside of the balloon. Then the situation is switched. The air pressure is increased, and the balloon deflates. This demonstration makes the relational causality obvious, and leads many students to revise their initial models of what gives a balloon its shape and size.

Steps

1. Present an inflated balloon to the class and ask, "What gives a balloon its shape and size? Think about this for a moment and then draw your ideas on paper." After several minutes, ask students to share their ideas with the class. *Presumably students will give unidirectional/linear models that focus on the air and/or pressure inside the balloon. Do not attempt to address these models yet.*
2. Tape the balloon to the top of a bell jar and place the jar on a solid base. Be sure to apply a generous amount of petroleum jelly to the bottom of the bell jar before placing it on the solid base to create the most efficient seal possible. Ask the students to note whether or not this set-up affects the balloon.
3. Place the second balloon by the side of the jar for comparison. Then reduce the air pressure inside the jar by attaching the pressure pump to the base of the set up and turning it on. Have the students observe what happens. *As the air inside the jar is removed, the balloon expands due to the differential in air pressure.*
4. Have students draw a model on a piece of paper or individual white boards.

5. Ask the students to watch as you increase the air pressure in the jar. What do they think will happen? Gather ideas from the class. *Adding air to the jar with the pressure pump results in the balloon imploding, due to the differential in air pressure between the lower air pressure inside the balloon and the higher air pressure in the jar.*
6. Have students draw a model. Invite students to also modify their earlier models if the results inspire them. Have students share and critique their models of what happened. Note which models account for the relational causality involved in the experiment.