Human Line To Show Different Waves

This is shown on the web at:
http://jclahr.com/science/earth_science/human_waves/index.html

Concept: Energy produced by an earthquake travels as two distinct types of waves, known as primary and secondary waves, through the planet.

Objective: Students will
- be able to distinguish between primary (P-waves) and secondary waves (S-waves)
- state which wave can pass through a liquid and which one cannot
- describe how earthquake waves travel through the planet

Materials
- A classroom of students
- Plenty of space.

Caution: These procedures involve students pushing, pulling, and bending each other. They should proceed cautiously and slowly. Pushing, pulling, or bending either faster or harder will not help and may hurt someone. You may want to have a spotter at the opposite end of the group from the leader, particularly for the two procedures involving P-waves.

Procedure
1. Have class describe an earthquake. Review or explain that energy from quake is released as wave. Point out that all the energy moves from the focus or origin point of quake. (*See introductory page on Seismic Waves for more information.*)

Procedure for P-wave in solid
1. Divide into evenly sized groups. Group size should be a minimum of six
2. Designate one student to act as the leader. This position should change with the different activities or have each student take a turn.
3. Have remaining students stand shoulder to shoulder with arms around each other.
4. Have leader gently push the first person's shoulder down and then pull them back to upright position.

Result
1. Each student should sequentially bump into each other. This is equivalent to a P-wave (compression) propagating through a solid (the earth).

These waves of compression travel through the earth at over 15,000 mph.

Procedure for P-wave in liquid
1. Have students line up again, shoulder to shoulder, but their arms should **not** be around each other's shoulder.

2. Have leader grab the first person's shoulder and push and then pull back to upright position.

Result
1. Each student should bump into each other. This is equivalent to a P-wave (compression) propagating through a liquid.

Procedure for S-wave in solid
1. Have students line up again, shoulder to shoulder, but their arms should **not** be around each other's shoulder.
2. Have leader bend first person at the end of line forward at the waist, hold for a half second, and then stand up straight.
3. As each student feels the person next to them bend they should then bend down.

Result
1. Each student should bend forward and then back. This is equivalent to an S-wave (also known as a shear wave) propagating through a solid.

Procedure for S-wave in liquid
1. Have students line up again, shoulder to shoulder, but their arms should **not** be around each other's shoulder.
2. Have leader bend first person at the end of line forward at the waist, hold for a half second, and then stand up straight.

Result
1. Only the first student should bend forward and back. The S-wave does not travel through liquid. How sad.

Detailed explanation of why S-waves don't travel through liquids?

Liquids don't have any shear strength and so a shear wave cannot propagate through a liquid. Think of a solid material, like a rock. That rock is made up of atoms and molecules bound to each other. When you set the rock down, its molecules and atoms stay in place and the rock holds it shape. This is because those bonds between the atoms and molecules have a certain amount of shear strength and they can resist the pull of gravity and stay together. Now imagine that you have a glass of water. If you put the glass of water on the table and then somehow remove the glass, the water will not hold its shape. Instead it will flow away along the surface of the table. This is because water (and most other liquids) do not have shear strength – there are no bonds holding the water molecules together that will resist a shear force.