

The Wave Exercise

By Marc Bonem, Santa Fe, NM, 2011

This activity is designed to create a physical, kinesthetic lesson for wave theory. In it, the students themselves model the wave. It may be best done outside depending on your students. If so, may want to use a megaphone or amplifier.

Review your instructions with the students before going outside.

1. Together, we will do “The Wave”.
2. Everybody lines up shoulder to shoulder.
3. You move only when the person on your left moves, etc.
4. Practice the wave a few times.

Talk about the definition of a wave: the students (up and down) move in place, but the energy moves down the line.

Amplitude

5. First we will move just our hands a few inches up and down.
6. Then only are arms up and down.
7. Then are whole bodies up and down.

What’s changing? The height of the wave (measured from the centerline) is called amplitude.

8. Do a small amplitude wave.
9. Do a large amplitude wave.

Wave Speed

Now we will do something a little different. We will vary the speed of the wave.

10. Do slow speed.
11. Do medium speed.
12. Do fast speed.

Discuss how waves move at different speeds through different kinds of matter.

Frequency

13. First explain that the students have been modeling pulses – a single disturbance. Many waves come from a continuous disturbance moving back and forth – a vibration. (Cue the Beach Boys)
14. Get one volunteer with a timer, a calculator and possibly a camera. Have him/her stand in front of the middle of the line.
15. Now we will do the wave one after another for 15 seconds. (This is super cool when the students get in sync.)
16. The timer person counts how many waves go by in 15 seconds.

Frequency is the number of waves passing a fixed point in a certain amount of time. It is usually measured in Hertz (Hz). Tell the students what their frequency was.

Wavelength is the distance between crests or troughs.

17. Do another continuous wave and have the volunteer try to estimate the wavelength. A photo or video would work well here. What would be the unit for this exercise? (People).

Longitudinal Waves

Notice, these have all been transverse waves. Everyone's motion is up and down, but the waves move sideways. How could we model a (longitudinal) wave?

Version 1(lite version)

Have everyone hold hands and pass a hand squeeze down the line.

Version 2 (rowdy version)

Have everyone stand shoulder to shoulder and pass a shoulder push (shove) down the line.

Reflection

You can also model reflection by sending a pulse to the end of the line and having that person send it back.

Geology/Seismic Waves

1. Line up students next to each other. In this exercise, students are modeling molecules, which are connected, in varying degrees, to students on either side.
 - a. Arms are unhooked. Students are modeling a fluid. Send a longitudinal (compression wave) down the line. These waves travel through liquids. Now bend over the student at the end of the line to model shear waves. Notice they don't travel in fluids.
 - b. Have students hook their arms at the elbows to the persons on either side in the line. Now they are modeling a solid. Have the student at the end of the line bend over at the waist. Now, the "bend" travels down the line. This models transverse or shear waves, which travel through solids. This is how *Beno Gutenberg* discovered the outer core of the earth was liquid.