THE DEMONSTRATION CORNER

THE CLASSROOM WAVE

by

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How about a physics demonstration with hundreds of moving parts that never needs to be fixed and doesn't require storage space? Hard to believe? Try doing THE WAVE in your grade 12 physics classes.

The following variations on THE WAVE let the students feel first-hand some of the points we try to teach in the Waves and Acoustics Unit. However, a caution is appropriate: I use only a few of these variations in a given year to liven things up and make a few points. As any regular Blue Jays fan knows, too many WAVES can become tedious.

UNIT OPENER

On the first day of the Waves Unit, I start the class by choosing something to celebrate (excellence on the last test, a great snowfall, the school football team). "To show our joy," I state, "we are going to do THE WAVE." I move my arm up and down along the rows of lab benches and we do THE WAVE a couple of times. By now, the students who were half asleep have realized that something is happening and we are ready for the unit introduction.

MOVEMENT OF A WAVE vs MOVEMENT OF THE MEDIUM

Students sometimes have difficulty separating a wave from the medium the wave travels in. I use a question/answer routine following a WAVE to help distinguish the two: which way did you move; which way did THE WAVE move; after THE WAVE passed you, where were you? A wave is a disturbance that passes by, leaving the medium more or less back where it started.

WAVE SPEED

Leading up to the universal wave equation, it is important to understand wave speed. On occasion, we do THE WAVE and measure the wave speed — a good example of "How far did it go and how long did it take?"

As often as not, someone is not paying attention and THE WAVE stumbles going past the guilty party. This is a good opportunity to talk about wave speed being related to the interaction between neighbouring people or molecules in the medium. Wave speed is a property of the medium, not of the particular wave. Any factor such as density or temperature that can affect the response time between neighbours affects the wave speed.

WAVE AMPLITUDE

We make big WAVES and little WAVES and discuss wave amplitude. I was concerned the first time I tried this, that the students would unintentionally adjust the wave speed too. This doesn't happen, and it encouraged me to explore the properties of a classroom WAVE further.

UNIVERSAL WAVE EQUATION

Actually THE WAVE is a wave pulse but my classes can make respectable continuous waves too: the first student simply starts a new WAVE at regular time intervals. This is great for a discussion of period and frequency of the motion of an individual student. Furthermore, crest-to-crest distances are easy to estimate and we're set to discuss wavelength. Trying two different periods, we can verify the universal wave equation.

TRANSVERSE AND LONGITUDINAL WAVES

With three dimensional visualization being difficult for some students, I use three weird versions of THE WAVE to discuss transverse and longitudinal waves. The students stand in a U around the edge of the room to perform these WAVES. In the first version, each student steps forward and back into line. In the second, each student does a small knee-bend. In the third, each student steps sideways to GENTLY bump the next student. The obvious follow-up questions are "Which way did you move?" and "Which way did the wave go?" This experience also leads naturally to a discussion of polarization.

A MODEL STRETCHED TOO FAR!

One year, I tried to show the effect of two colliding wave pulses. The students at the point of collision were so baffled that they did nothing and both pulses died. To this day, those students believe in their hearts that the superposition prinicple is a hoax. I still regret that I wasn't fast enough on my feet to turn the experience into a lesson on the breakdown of analogies in scientific thought!

A FIELD TRIP?

Doing THE WAVE a few times is good fun. Almost every year, a student suggests that we put our theories into practice and plan a visit to the Sky Dome. And hardly a WAVE goes by without someone adding "GO, JAYS, GO!"

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Submissions describing demonstrations will be gladly received by the column editor.