

A DIFFERENT VIEW OF THE LAW OF STRINGS or SQUAKERS AND GOBBLERS
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The Law of Strings states that the longer the length of the string or the thicker the width of the string the lower the tone produced and the shorter the length or thinner the string the higher the tone. This means that just as you found the length of the string was the decisive factor in the motion of a pendulum it holds the same importance in the production of sounds in a stringed instrument. A violin is one such instrument that produces standing waves whose frequencies depend on the length of the strings. A variety of standing waves can occur when a string is fixed at one end and set into vibration at the other by stroking or plucking. In order to hear sound a vibration must be produced in this fashion using a sounding board or resonance (echo) chamber. A vibration is a wiggle in time and a wave is a wiggle in space and time. A transverse wave occurs when the motion of the medium is at right angles to the direction in which the wave travels. A longitudinal wave occurs when the particles move along in the direction of the wave. The high points on the wave are called crests, and the low points are called troughs. The distance between the center of one crest to the center of the adjacent crest is known as a wavelength (λ). The midpoint of the wave is called the nodal line or node (null point) and the amplitude (maximum displacement) refers to the distance from the midpoint to the crest (or trough) of the wave. How often a vibration occurs in an amount of time (period) is known as the frequency and is measured in hertz (Hz). Frequency and period are inverses (reciprocals) of each other. When two waves overlap they form an interference pattern, if the crest of one wave overlaps the crest of another, their individual effects add together or reinforcement each other (constructive interference) if the crest of one wave overlaps the trough of another the effects cancel (destructive interference). In an Earthquake the wave motion starts as a set of Primary (P) waves which are longitudinal where the particles are compressed then expanded and travel horizontally in the direction of the force of the P wave. In the Secondary (S) waves the particles move as vertical transverse waves (up and down, perpendicular to the earth) at a 90° angle in the direction the S wave travels. The Last (L) wave is a surface horizontal transverse wave which moves side to side at a 90° angle to the direction that the surface wave travels. This type of surface wave is the most destructive.

Students can be given different sizes of resonance (echo) chambers to use to assemble a simple one stringed instrument. Possibilities might include plastic buckets, trash cans, oatmeal containers, plastic frosting containers, plastic glasses, plastic medicine cups or other cylindrical containers. Measure approximately one meter of string threading one end through a hole that has been punched into the bottom of the container. That end of string will be tied to a toothpick or wooden splint and taped on the outside bottom of the container. The free end of the string that hangs from inside the container will be tied to a small piece of sponge used to protect the fingers during stroking. When you complete your stringed instrument check its ability to produce sound. Wet the piece of sponge and use it to grip the string where it comes out of the container being used as an echo chamber. Use the sponge to wet the string. As you slide the sponge down the length of the string you will notice that some kind of a sound is produced. Repeat this procedure several times until you are able to make a series of different sounds. Students can compare the sounds of each instrument, classify the sounds, and notice the different sounds with different lengths of string or difference in intensities or loudness with changes in tension and differences in the sound produced from different sizes of containers.

If this activity is to be done around a Holiday, for Parent Night, or Friday Follies you can decorate the containers using construction paper, felt, glue, doll eyes and any other craft items available. Medium sized containers can be decorated as chickens, roosters, geese or turkey gobblers and small plastic medicine cups baby chicks for Easter. Oatmeal containers and larger plastic containers can be made into sheep, goats or cows. These instruments are sometimes called "Squakers" or "Gobblers" because of the sounds produced.