Smithsonian Latino Center

¡DESCUBRA!

Meet the Science Expert

¡DESCUBRA! CREATE-IT POCKET SCIENCE HANDOUTS

DESIGN AND BUILD WIND INSTRUMENTS

1. Overview:

Working with different sized straws and other materials (see the list in the "Preparation" section below), children will learn to design and construct instruments called *membranophones*. These instruments produce sound through the vibration of a membrane tautly stretched over a cavity. Drums are membranophones, so are kazoos. The membranophone that the children will construct in this exercise will look like the illustration in Figure 1. Once they have built a basic membranophone, the children will modify it to produce different frequency sounds and to amplify the sounds it makes.

As part of this experience, children will gain a basic understanding of how sound is made and how it travels. They also will learn some elementary properties of sound, such as how low sounds and high sounds are produced and how sound must travel through a medium (air or water) in order to be heard.

- Age level: 8-10 years
- Time frame:
  - o Preparation: 35 minutes
  - o Activity itself: 45 minutes

TELEMUNDO

¡Descubra! Meet the Science Expert is made possible, in part, through program support provided by NBCUniversal Telemundo Enterprises.
To learn more about our sponsor's educational resources, visit http://www.telemundo.com/el-poder-en-ti/tu-educacion.

2. Background:

"Sound is vibration" is a seemingly simple statement that describes an extremely complex idea. All that young people need to know here, however, is that if they shake (vibrate) something fast enough, they will be able to make a sound. For example, if you vibrate something 60 times per second, you will make a sound that has the same tone as the hum of your refrigerator. And, if you vibrate something 256 times per second, you will make a tone just like a piano's middle C. The faster an object vibrates, the higher its pitch; the slower it vibrates, the lower its pitch. Longer instruments make lower sounds than shorter instruments.

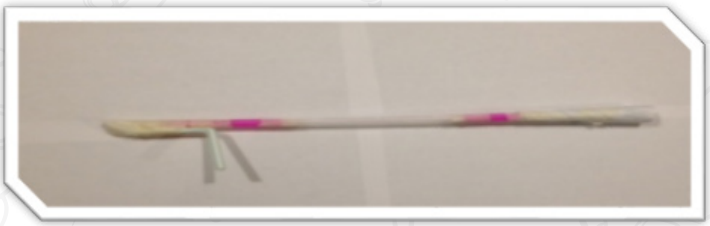

Fig. 1

By blowing air into the elbow straw, the air pressure will move the rubber membrane up, but because it is elastic, it will snap back. The rate at which the membrane goes up and down depends on the length of the straw

3. Preparation:

- Materials for each child:
  - four 3/8-inch bubble tea straws
  - two regular-size elbow joint straws
  - one latex glove
  - two 5-inch long, 3/8-inch outside diameter clear soft plastic tubing (plumbing tubing)
  - two sheets of computer paper
- Additional materials:
  - one roll of masking tape per four children
  - one hole punch per eight children
  - one scissors per child

TELEMUNDO

¡Descubra! Meet the Science Expert is made possible, in part, through program support provided by NBCUniversal Telemundo Enterprises.
To learn more about our sponsor's educational resources, visit http://www.telemundo.com/el-poder-en-ti/tu-educacion.

4. Making and Doing:

Making a membranophone

Cut the elbow straw crosswise in half; discard the portion of the straw without the elbow joint. Have the child cut out a finger from the latex glove and then cut a small opening at the finger tip, just large enough for the elbow straw to fit through. Insert about one-half inch of the elbow straw (you may use either tip of the straw for this) into the hole and tape the straw securely onto the latex finger, as shown in Figure.2.

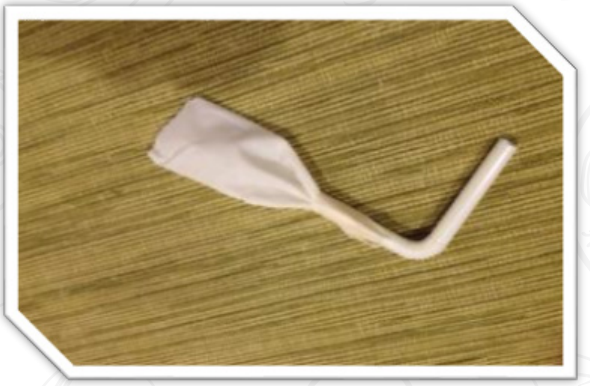

Fig. 2

Next, insert roughly one-half inch of the bubble tea straw into the remaining open end of the latex finger and tape the finger from the outside, as shown in Fig. 3.

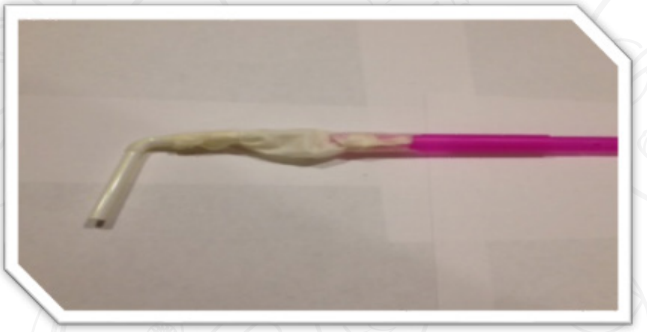

Fig. 3

The next step requires two sets of hands. Pre-cut about two inches of masking tape. Have the child bend the elbow joint and begin blowing into the straw, continue to bend the elbow until a pure tone is heard. As soon as the tone is heard, tape the narrow straw to the wider one (using the pre-cut masking tape), as shown in Fig. 4. (If you lose the tone, just undo the tape and repeat the process until you find the tone again.)

The child now has constructed a one-note membranophone, and now the real fun can begin—additional notes can be added to the instrument and its sound can be amplified.

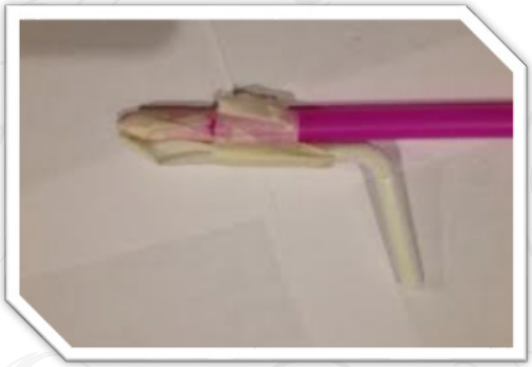

Fig. 4

Making a flute

Have the child cut a large straw lengthwise through the middle with the scissors (Fig. 5). Then punch two or more holes, about one-inch apart, anywhere along the sliced straw's length. Finally, attach the sliced straw to the existing large straw, slipping it over its end and taping the slit shut so no air can escape.

By covering the holes with his or her fingers, the child can change the sound. The shorter the path of the air flow, the quicker the vibration and the higher the pitch. Covering the holes along the length of the straw shortens or lengthens the straw, which creates different pitches—**just like playing a flute.**

TELEMUNDO

¡Descubra! Meet the Science Expert is made possible, in part, through program support provided by NBCUniversal Telemundo Enterprises.
To learn more about our sponsor's educational resources, visit http://www.telemundo.com/el-poder-en-ti/tu-educacion.

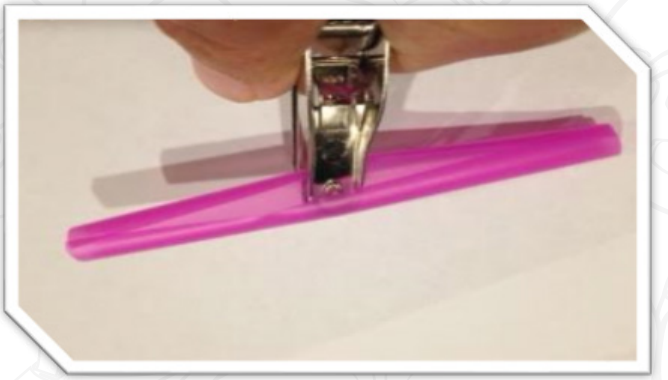

Fig. 5

Making a trombone

The pitch can also be lowered by lengthening the cylinder. To do this, slice about ¾ of an inch from the straw and slip a new straw into the musical instrument, as shown in Fig. 6. Straws have a blunt end and pointed one. When joining one straw to another, insert the pointed end of the second straw into the blunt, slit end of the first straw. Then tape the junction so that no air escapes.

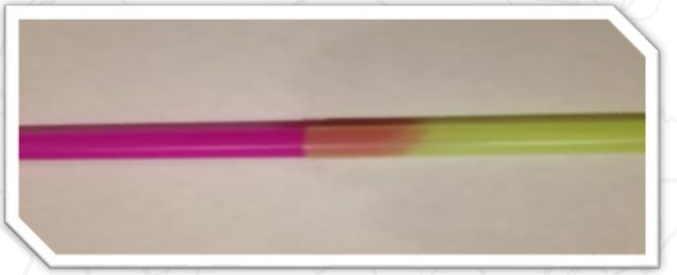

Fig. 6

The instrument can also be lengthened or shortened by cutting a large straw down the middle and slipping it over the vibrating straw, then putting tape along the length of the straw and sliding the large straw back and forth. Make sure the assembly is loose enough to allow the larger straw to easily move in an out—**just like a trombone.**

TELEMUNDO

¡Descubra! Meet the Science Expert is made possible, in part, through program support provided by NBCUniversal Telemundo Enterprises.
To learn more about our sponsor's educational resources, visit http://www.telemundo.com/el-poder-en-ti/tu-educacion.

Making a trumpet

Now let's make the instrument louder. First let's make a cone—called a *bell*—out of computer paper and attach it to the end of the instrument. Most wind instruments have bells—think of trumpets, saxophones, and clarinets. Any time you join straws or bells make sure that you tape the joints well. Air leaks will affect the sound of the instrument. You can also attach a 3/8-inch piece of plastic tubing between the bell and the straw to further amplify and redirect sound. (See Figure 7.)

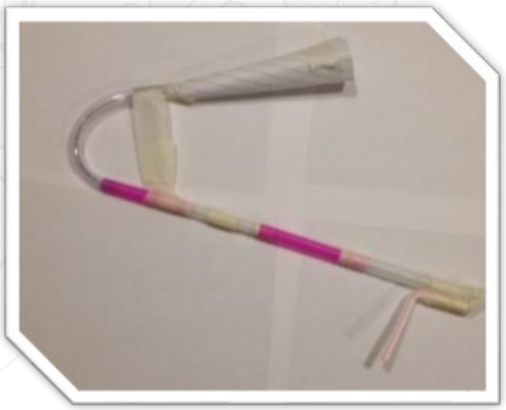

Fig. 7

Lessons learned:

By learning to build musical instruments, the children will gain an insight on the science of sound. They will come to understand the meaning of tone and pitch, and their relationship to the size, length, and shape of an instrument.

Each one of these experiments will pose some construction challenges—and that is a good thing. Most contemporary learning theory agrees that deep understanding happens best when a student works through the struggles that lead to success. Humans are wired (programmed) to learn from mistakes. For example, if a student were to get overly ambitious and build an overly long instrument that is too long, this will require that he or she blow harder. Moreover, even though this longer instrument will have a lower pitch, blowing harder—called *over-blowing*—will make the sound move up an octave. This is precisely how trumpet players get more than one octave from an instrument that has few valves.

This activity will enable the children to emerge with a sense of success tempered by a bit of struggle from overcoming obstacles. Who knows? Some of these children may be inspired to find out more about sound and music. Some may even want to pursue a musical career playing wind instruments.

Smithsonian Latino Center

My Notes and Observations

TELEMUNDO

¡Descubra! Meet the Science Expert is made possible, in part, through program support provided by NBCUniversal Telemundo Enterprises.
To learn more about our sponsor's educational resources, visit http://www.telemundo.com/el-poder-en-ti/tu-educacion.