

Lesson Plan

Assessment
Cross-curricular

AFL-rubric
Arts

Big Ideas:

- Sound is created by vibrations
- Light is needed to see

Learning Goals:

- Explore how to create the best amplifier (greatest resonance) by building one for an instrument.
- Gain an understanding of how the properties of light can be used to create a light show, by putting one together.

Specific Expectations

- 2.2** Investigate the basic properties of light
- 2.3** Investigate the basic properties of sound
- 2.4** Use technological problem-solving skills to design, build, and test a device that makes use of the properties of light or sound
- 2.6** Use appropriate science and technology vocabulary, including natural, artificial, beam of light, pitch, loudness, and vibration, in oral and written communication
- 3.6** Describe how different objects and materials interact with light and sound energy

Description

This is **lesson 3** of a series of five lessons where we look at light and sound through the prism of creating a rock concert (or other light and sound show). Each lesson can be done on its own as well.

Materials

- Coloured crepe or tissue paper, semi-transparent foil wrap, or glass paint
- Small mirror pieces, CDs that can be cut up, or aluminum foil
- Table lamps, flashlights and/or spot lights
- Styrofoam balls
- Fishing line or string
- Cardboard boxes of varying sizes (ask students to bring them in)
- Paper
- Masking tape
- Scissors
- Craft glue

Safety Notes

Potential fire hazard. See the Action section, Light Show.

Introduction

In this lesson students will work in groups on a project to build something that explores the properties of light or sound. The end goal is to contribute with their creation to a light and music show to be performed in the last class of this set of lessons. Students can choose one of two options:

- Decorate lights and/or create a device that reflects light
- Build an amplifier for an instrument or mobile device

A selection of instruments (used in the last lesson) should still be available for use.

OPTIONAL: Allow students to create an amplifier for a mobile device.

- You may not have enough instruments or you may simply choose this as an interesting option.
- If students do this they should start by downloading an app that allows them to create music. The idea is that they will be able to perform music with their device that is amplified by their creation to contribute to the music show.
 - Suggested apps: Garage Band (for Apple devices), Walk Band (for Android)

Getting started – Sound amplification

- Today we will get started with creating our show. We will need to work on light and sound effects. We already have some instruments so what we will do is create an amplifier for our devices. You may be thinking of an amplifier that uses electricity to amplify for example a guitar. We can also create a simple amplifier that amplifies the vibrations an instrument or speaker makes. We played around with amplification in our last lesson.
- Who has a suggestion for how you could amplify the sound coming from an instrument or speaker (for example a speaker of your phone)?
 - Get them to discuss those materials that VIBRATE with sound to create amplification.
 - Remember that instruments such a guitars use a sound box to amplify. They may want to build something similar.
- Students play around to create the greatest possible amplification. You can use any of the materials provided:
 - Cardboard boxes, paper, scissors.

Getting started – Light effects

- What would be cool to have for light effects in our show?
 - Remember the properties of light: different colours and reflection
 - Explore how you can combine different colours to create a third colour. For example what colour do you think you get if you combine red and blue? Try it out!
 - For this they will need to shine a blue and a red light (after creating it with paper or foil) onto a white surface in a darkened room or in a dark box and observe the colour of the surface.
 - They could also build a mirror ball (using supplied materials) or something similar like a string with mirrors attached to it.

After discussing the options it's time for the students to form small groups (no more than 2 or 3) based on their interests. It's important that we have at least one group working on light and one group working on sound. The point is really to come up with a show that demonstrates how making use of the properties of light and sound can help us make some really cool things!

Action

Note that the attached rubric 'Assessment for Learning' is similar to evaluate the final product in lesson 5. You can use these criteria to give students feedback at an intermediate stage and point the way to what they can improve for before the final show.

Sound Amplification

- Each group of students should take a set of supplies:
 - An instrument
 - Paper and/or cardboard (or other material) to build amplifier out of
 - Scissors, tape/glue
- Encourage students to experiment and try several different ideas. For example:
 - Is it better to put the instrument/device inside or on the outside of the amplifier?
 - Does the type of material make a difference?
 - Does the quality of the music change depending on the design (i.e. what sounds best?)
 - Does making a hole in the amplifier increase or reduce the effectiveness?
- Optional: Give the students some links of existing amplification devices from the list given in the resources

Light Show

- **Safety First:** Make sure that your lights do NOT get too hot. They could set the material you place in front of them on fire. It is best to use light bulbs that don't heat up too much. And it's important to monitor the temperature of the material in front of the bulbs as you go!
- Students should take a set of supplies. Note that it's fairly easy to make coloured lights, so each group may want to make some coloured lights AND a way to reflect them, such as a mirror ball or shiny objects on a string etc. Creativity encouraged!
 - Light sources
 - Coloured paper, plastic, paint etc.
 - Craft supplies
 - Styrofoam ball and/or string, small mirrors or aluminum foil
- For this activity it is very helpful to have a dark area to test their creations. If the whole classroom can't be darkened, a large cardboard box can work really well. Attach a white piece of paper at the back of it and make an opening just big enough for students to shine lights in and look at the results.
- Encourage things to try. For example:
 - Try holding something between the light sources and the white surface (such as your hand or a pencil). What colours do you see in the shadows? Why?
 - Can you come up with a way to make a flickering effect? For example by making a cardboard disk with a hole in it that can be spun in front of the light source...

- As you circulate, encourage students to explore different options, try to understand why they get the results they do etc.
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Consolidation/Extension

- Class can work together to create a light and music show. This is the focus of the next two lessons.
- Reflection:
 - For what pitch of music did your amplifier work best? (They should find that large amplifiers would work particularly well to amplify lower pitched sounds – because they have a larger wavelength). This is why bass speakers are always bigger than tweeters that make the higher pitched notes.
 - What colour do you get when you combine red, green, and blue light? (White). What other colour combinations can you create?
 - How could this be used in technology? (To make screens for example. Red, white and blue LEDs are used to make ALL the colours you see on a screen. Take a magnifying glass to your TV screen to verify!)

Links

- Amplifier:
 - Making an iPhone amplifier from a bowl or Gillette deodorant cap: <http://www.instructables.com/id/How-To-Make-a-Simple-iPhone-Amplifier/>
 - A wooden design that could be copied out of cardboard: <https://www.youtube.com/watch?v=IIZRT3An5N0>
 - A Google image search for xylophone is quite instructive all on its own! Similarly looking at images of stringed instruments will quickly give you an idea how every instrument has a sound body built in to make the vibrations louder.
- Light effects:
 - How to make a mirror ball: <http://www.wikihow.com/Make-a-Disco-Ball-with-CDs>
 - Colouring lights: http://www.ehow.com/how_4841765_color-light-bulbs.html
 - A science fair project on coloured lights: <http://www.education.com/science-fair/article/colored-lights-effect/>
 - Cellophane to colour lights: https://www.powerhousemuseum.com/pdf/education/special_fx_2007_activity_guide.pdf

French Sites:

Fabriquer un amplificateur pour iPhone : <http://www.mygsm.fr/fabriquer-votre-amplificateur-pour-smartphone/>

Démonstration comment fonctionnent les filtres : <http://www.c4h10.net/mod/resource/view.php?id=703>