SCIENCE NORTH SCIENCE NORD
SUDBURY, ONTARIO, CANADA

Optics Inventions **Grade 10 Applied – Light and Applications of Optics**

Lesson Plan

Assessment	Observe, discuss, rubric
Cross-curricular	Careers, Technology

Big Ideas

- A wide range of technologies utilizes the properties of light and colour.

Learning Goals

- Learn some of the ways that people are creating optical devices from their phones
- Learn how to create projector

Specific Expectations

E1.2 describe the role of selected optical technologies in the transmission of information, and analyse their impact on society
E2.1 use appropriate terminology related to light and optics
E2.3 use an inquiry process to investigate the refraction of light as it passes through a variety of media
E2.4 predict the qualitative characteristics of images (e.g., location, orientation, size, type) formed by converging lenses, test their predictions through inquiry, and draw ray diagrams to record their observations
E2.7 construct an optical device
E3.8 explain how the properties of light or colour are applied in the operation of an optical device

Description

In this lesson students will make their own cell phone projector. They should have an understanding of how to draw simple ray diagrams.

Materials

For each group:

1 simple lens
1 shoebox
1 sheet of chart paper
1 ruler
Tape
Dark paper
Materials for making phone stands
Internet access
Optics Inventions (Planning, Experimental Write-up and Summative Assessment)

Safety Notes
None

Introduction

- Introduce students to some of the amazing ways that people are creating their own homemade optical devices.
- Show the following:
    - **Engineers create Smartphone magnifier for First Responders** https://www.youtube.com/watch?v=QIh9dnwnt7Y
    - **Homemade microscope** https://www.youtube.com/watch?v=KpMTkr_aiYU
    - **Smartphone Hologram Maker** https://www.youtube.com/watch?v=7YWTtCsvgvg
- Smartphones have pretty interesting optics and if students are interested in learning more an excellent (and short) breakdown can be found here: https://www.youtube.com/watch?v=ldS_yHnZMDs

Action

- Students will create their own data projectors using simple lenses, cardboard, a cell phone, and a process of inquiry.
- Split students into groups of 2-3. Show students slides 1-6 of the 'Optics Intervention Visuals'.
    - It is easiest to restrict student inventions to only cell phone projectors, but, depending on ability and student access to phones, the inventions could be extended to telescopes, overhead projectors, microscopes, etc.
- Give students 'Optical Inventions Planning', and have students complete their plan as a group using online sites or videos to inform their plans.
- It is suggested that you allow students to find their own instructions online as this builds their information searching skills.
    - If students search for 'How to make a cell phone projector' the top six results (a mix of webpages and video) are all excellent and a little varied.
    - Alternatively you might provide students with the following 'Instructibles' link: http://www.instructables.com/id/How-to-make-a-projector-for-your-iPodiPhone-for-a/
- Students will bring their plans to the teacher for approval.
- Once approval is given they will get their lens and shoebox and begin to construct their projector.
    - Access to a fairly dark location will be very beneficial for testing projectors.
- Students should experiment with the placement of the cell phone and distance from the projector to the paper screen.
    - Their goal is to get an image as large and clear as possible.
- Once their device is completed, give students 'Optics Inventions Experimental Write-up' and have them complete it individually, but with input from their group members.
- Once completed, all groups should gather close together and have the chance to each choose a school appropriate video clip to share from their projector.

Consolidation/Extension

'Optics Inventions Summative Assessment' can be used to do an assessment of learning by the teacher. Students should first complete the rubric as a self-assessment and return to the teacher.

For further consideration, students could be introduced to the Cloaking Device
https://www.youtube.com/watch?v=oJb9RnAVDuE
Explanation:
https://www.youtube.com/watch?v=GAmWs6zfTj8

This activity could be easily converted to include telescope creation, requiring only 2 lenses and cardboard tubes: http://www.instructables.com/id/How-to-make-a-Telescope/