Looking through the Eyes

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Host Organization: Stanford University **ETP Type:** Classroom
Subject/Grade: Science/4th Grade

Abstract

Students growing up in today have little exposure to hands-on technologies that can help them to experientially understand the workings of the eye; yet, the eyes and an understanding of light (and how it moves) are essential to understanding many of today's technologies. Therefore, I wanted to design a lab that would help them to better understand how the eye works, then demonstrate their understanding of that knowledge with a project to put that understanding into action by building a camera obscura.

Focal Content & Supporting Practices

Waves and their applications in technologies for information transfer, more specifically how the eye sees; DCI -- 4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen; CCC -- Systems and System Models as well as Structure and Function

21st Century Skills and Applications

Developing and using models -- students will be building a model of the eye
Obtaining, evaluating and communicating information -- Will learn the basics of the eye, then will be tasked with using that information to explain their model of the eye

Measurable Objective(s)

SWBAT create a working model of the eye and explain its parts and functions

Formative Assessment(s)

- Provide a list of questions for students to answer regarding how image is transmitted onto sun paper
- Provide a checklist for students to use after they build their camera obscura that details out what improves the image and its clarity, e.g., use of aperture

Summative Assessment(s)

In pairs, have the students build a working model of the eye and explain how it works by writing out a script and reading it to me with each student having an equal role in the explanation process. There will be a rubric they will receive beforehand to guide them including a list of expected parts to be covered.

Fellowship Description

I am working with the Hong Neurotechnology Lab on Neural Interface technologies. The lab works on developing new tools based on the latest materials to figuring out a way to interface the brain's neurons at the single neuron level as a way to better understand brain functioning and the ultimate goal of interfacing the brain and computers for use in patients suffering from Alzheimer's and Parkinson's diseases as well as applications for those with traumatic brain injuries. One of the papers out of the lab

spoke about how the lab created a mesh interface to deliver light impulses to the eyes to stimulate the nerves.

During my fellowship, I am learning about the group's inner workings, reading about the basics of neural science and materials science as well as participating in conversations on current research available. I am learning a lot about the fields of both neural and materials science. One of my goals is to be able to translate this information through relevant lessons to lower school students to get them excited about this as a possible career.

In addition, I am witnessing 21st Century skills in the actions of the group -- attention to detail, group work, building on known strengths for each person, information analysis, flexibility and adaptation (given the current coronavirus constraints), as well as initiative and self-direction.

Fellowship Connection to School/Classroom

In the fourth grade, students study the human body in general. One of the systems that we study is the nervous system. Reading the "Principles of Neural Science" book has deepened my knowledge and appreciation of this system and how seamlessly it functions with other body systems. In addition, the students look at energy and energy transfers as well as waves and their applications in technologies for information transfer. This lab's work deals directly with that NGSS standard. Being able to have had experience in this work and be able to communicate that work to students to excite them about several fields they may not have thought of before (materials science and computer interface) is a unique opportunity.

There are many 21st Century skills that are used in the lab that I will continue to emphasize and use in my classroom -- communication in group work where each person is respected for what they can bring to the project; flexibility in an environment that is a new normal for us all and the creativity needs to adapt your work to that environment; and the importance of taking initiative and self-direction.

I would also like to get at least two researchers from the lab to come to speak to the students virtually about their journey into their field and their work (one woman and one man). Being able to see and hear from researchers like them in the field doing such incredible work will be exciting and inspiring!

Host Organization Engagement

The students should finish their work on the body systems and have built their model of the eye around the month of November. I would like to have two members of the lab (one male and one female) speak to the students about their experiences and work.

Instructional Plan

Unit Title: **Looking Through the Eyes**

Day #	Simple Objective	Materials/Teacher Prep
1	Introduce Light Energy and Get up to Slide #7 and have the students talk about then do the activity	Background information for teachers Light Presentation and activity (home and school version) with sun print or construction paper and various light bulbs

2	Preview previous day's slides then continue with Light Presentation, go up to slide #20 on eyes, then watch video and do a quick assessment by having students take the quiz	Video - BrainPop video on the functioning of the eyes
3	Preview previous slides, then begin Light Presentation and add Generation Genius video. End at slide #33	Video - Generation Genius video on Light
4	Preview previous slide, then begin at slide #34 on Light Presentation.	Hand out Camera Obscura final project, and rubric
5-7	Begin Camera Obscura final project	Camera Obscura video Camera Obscura in Cliff House/San Fran. (possible field trip) Camera Obscura final project Camera Obscura rubric

	Content Standards	
	Waves and their applications in technologies for information transfer, more specifically how the eye sees; DCI -- 4-PS4-2 Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen; CCC -- Systems and System Models as well as Structure and Function	
	Previous Content Knowledge/Vocabulary	
	See background information for teachers; all vocabulary bolded and defined	
Timing	Day 1 - Lesson 1	Assessment
	Objective(s):To introduce the idea of light. *Focal question: What is Light?* **Student/Teacher Activities: Sun Print activity**	Questions on Sun Print Activity
Timing	Day 2 - Lesson 2	Assessment
	Objective(s):Introduce the way the eye works *Focal question: How do we see?* **Student/Teacher Activities: Turn and Talk**	Formative assessment from Turn and talk sessions
Timing	Day 3 - Lesson 3	Assessment
	Objective(s): SWBAT explain how light travels *Focal question: How does light travel? How do we use light?* **Student/Teacher Activities: Think, Pair, Share**	Exit Ticket

Timing	Day 4 - Lesson 4	Assessment
	Objective(s): Understanding how lenses work. *Focal question:* What are lenses and how do we use them? **Student/Teacher Activities: Flashlight exploration with lenses**	
Timing	Days 5-7 - Lesson 5-7	Assessment
	Objective(s): Students will build a camera obscura with lenses and an aperture (which serves as the pupil) *Focal question: How can we focus the light in our Camera Obscura?* **Student/Teacher Activities: Camera Obscura Activity; and rubric**	Camera Obscura final project sheets and video or picture review. Rubric will be used to grade.
Timing	Days 8 - Lesson 8	Assessment
	Objective(s): Students will talk to scientists from Stanford's Hong Lab to learn why neural scientists study the eye. **Focal question:** What is a neural scientist, and what do they do? **Student/Teacher Activities:** Video call or in-person session with scientist; questions before visit; thank you card	

In-Person Enhancements

One would be to teach students about how pupils work by turning lights in the classroom on and off while they watch each others' pupils.

Supply List

Listed on each day and activity

References

"Basics of Vision." Pacific University, 16 Oct. 2017. www.pacificu.edu/academics/academic-support/centers-institutes/vision-performance-institute/basics-vision.

Kandel, E.R. et al. "Principles of Neuroscience, Fifth Edition." McGraw-Hill Companies, Inc., New York, NY. 2013.

Keywords

Light, Electromagnetic Spectrum, Eyes, Camera Obscura

Links to Files in this ETP

Background:
https://docs.google.com/document/d/1DunOw0ekJHzp2duHM40-yP7Owk3m1JmSMwpg32ZbAQs/edit?usp=sharing

Light Presentation:
https://docs.google.com/presentation/d/1PYfJ_eOVoJCA4Uy9Z_mvBNl_PUdi4zytCRz2rzUFXNU/edit?usp=sharing

Sun Print Activity:
https://docs.google.com/document/d/1__TmPE7cRr1GWU3P6EaICiprNeqIhVQwbQgIJ5j1yAI/edit?usp=sharing

Light Exit Ticket:
https://docs.google.com/document/d/1osV7BGsPv74kMOv5I8f7YfFKqzV3ekBFXngRtuty_3M/edit?usp=sharing

Camera Obscura final project:
https://docs.google.com/document/d/1Y4t2jUp0sast4BqGfJLdSEYMewQgNrhcPaHnZKkADy0/edit?usp=sharing
Rubric:
https://docs.google.com/spreadsheets/d/1pP-nixW7ouQgm0IZqIVV1OV7LbIeAmNXTHBpvc2oyB4/edit?usp=sharing

Camera Obscura video:
https://www.exploratorium.edu/video/camera-obscura