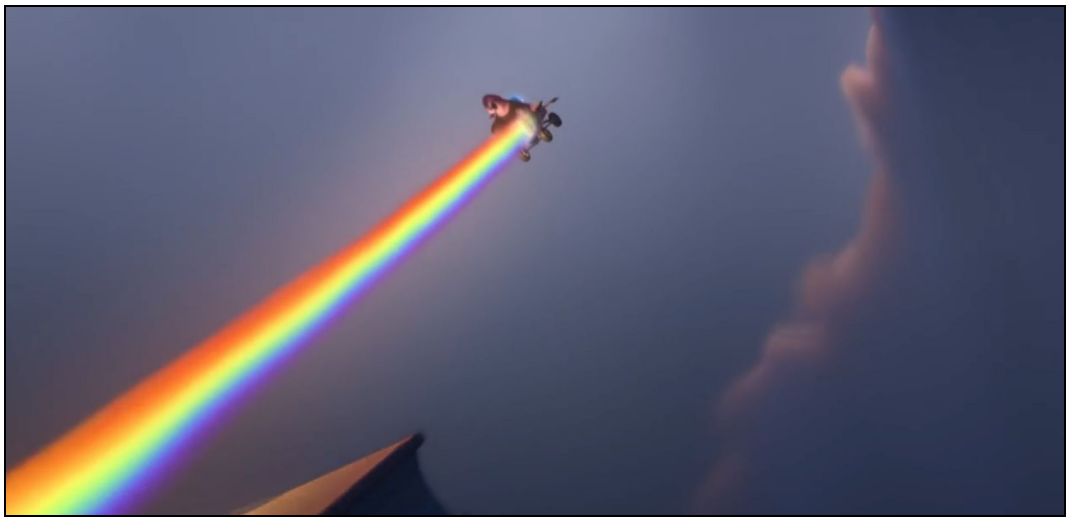
COLOR SCIENCE: FIRST LESSON (link to lesson)



Standards alignment:
NGSS:
MS-PS4-2,
MS-PS4-1

Summary/Overview:
Just as dialog, acting, and music are tools filmmakers use to convey meaning and emotion, color can be used to the same effect. But determining “color” is not as simple as saying “red” or “brown” because there are endless shades of color in the visible spectrum. In this lesson, you will learn how color is determined partly by the physics of light and partly by how our brains perceive it.

Lesson Structure: This lesson contains 7 videos and 5 practice exercises which alternate back and forth. One way to run this is to watch and discuss all videos as a group (using a screen at the front of the room) while letting students return to their computers to do the exercises when required.

Total Time Recommended:
Approximately 60 minutes to complete the videos and exercises.

Age: Grade 5 - infinity and beyond!

Objectives:
In this lesson, students will:

- Explore how color is represented and manipulated in Pixar films.

Materials Needed:

- Indoor classroom, lab, or open space with seating and access to the Internet. Space should have enough seating, ideally facing a teacher/facilitator’s projection screen.
- Teacher/facilitator should have a computer connected to a large monitor or projector and speakers.
- This lesson assumes that each student or pair of students will require a device to access the lessons online.

VIDEO 0: Color Science (length: 3 mins)

Instructions: Have everyone sit where they can see the screen. Before playing the first video, start with the question “can anyone tell us what color is?” Then, from the lesson page, play the video “Color Science” When the video ends, start a discussion with your group using questions below.

Discussion questions (5 mins):

- **Q:** Can you think of a scene from a movie where you vividly remember how color was used?
- **Q:** If you were a color, what would your attributes be? How bright or dark, how intense, where on the rainbow spectrum?

VIDEO 1: Spectrum of light (length: 4 mins)

Instructions: Every light sources makes a different kind of rainbow, known as a spectrum. Have everyone sit where they can see the screen. From the lesson page, play the video “Spectrum of light.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Color -** One property of light
- **Spectral Power Distribution** - The intensity of light at each wavelength

Discussion Questions (3-4 minutes):

- **Q:** Why does sunlight look white?
- **A:** Because it contains all visible colors
- **Q:** Which has more color intensity, daylight or a candle?
- **A:** Daylight has more intensity

PRACTICE: Understanding spectra (5-10 mins)

6 problems covering some key concepts

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about spectra in this exercise?

VIDEO 2: RGB color model (length: 3 mins)

Instructions: Overview of the RGB color model. Have everyone sit where they can see the screen. From the lesson page, play the video “RGB color model.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Cones -** Color receptors inside our eyes that blend three types of wavelengths to create all the colors we see.
    - Sensitive to red light / longer wavelengths
    - Sensitive to green light / medium wavelengths
    - Sensitive to blue light / shorter wavelengths
- **Tetrachromats** - A special, female population with 4 color receptors instead of three, allowing them more precise discrimination between colors.

Discussion Questions (3-4 mins):

- **Q:** What is a pixel?
- **A:** A tiny rectangle on a computer screen divided into three even regions - red, green and blue.
- **Q:** If most humans have 3 color receptors (red, green and blue) and the Mantis Shrimp has 12, what do you think the other 9 colors receptors could perceive?
- **Q:** Which color has a longer wavelength, red or blue?
- **A:** Red
- **Bonus Question:** Why is the sky blue?

PRACTICE: RGB Color Matching (length: 15 mins)

8 problems covering basic concepts

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about RGB Color Matching in this exercise?

VIDEO 3: HSL color model (length: 3 min)

Instructions: Have everyone sit where they can see the screen. From the lesson page, play the video “HSL color model” When the video ends, check for clarifying questions before proceeding to the next exercise.

Key terms / Vocabulary:

- **Hue -** Actual color is in the rainbow spectrum
- **Saturation -** Color intensity
- **Value -** How bright something is relative to something else
- **HSL - Short for** *Hue*, *Saturation* & *Lightness* adjustments on a color wheel, a more intuitive way to find colors than RGB.
- **Achromatic -** without color, desaturated

Discussion Questions (3-4 mins):

- **Q:** How is the HSL color model different from RGB color model?
- **A:** HSL is easier (or more natural way) to identify specific colors with.

PRACTICE: HSL color matching (length: 15 mins)

8 problems covering basic concepts

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about HSL color matching in this exercise?

VIDEO 4: Color Contrast (length: 4 min)

Instructions: In this video we will explore how perception plays a role in the colors we 'think' we see. Have everyone sit where they can see the screen. From the lesson page, play the video “Color Contrast.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Contrast -** The differences in illumination or color
- **Director of Photography (DP)** - Someone involved in decisions about color or lighting in a scene.

Discussion Questions (3-5 mins):

- **Q:** Why would you want to increase or decrease contrast in a scene?
- **A:** To to draw the audience’s attention to a specific region of a scene
- **Q:** Can you think of two colors that contrast each other the most?

PRACTICE: Color contrast (length 5-10 mins)

5 problems covering basic concepts

Instructions: After students are nearly finished, check for understanding before moving on to the next video (remind students they can find help in the hints for each question.)

Exercise Questions:

- **Q:** What did you learn about color contrast in this exercise?

VIDEO 5: Color correction (length: 4 mins)

Instructions: In this video you will visit our color suite to see how we tweak colors to meet artistic goals. Have everyone sit where they can see the screen. From the lesson page, play the video “Color correction.” When the video ends, start a discussion with your group using questions below.

Key terms / Vocabulary:

- **Colorist -** Someone who adjusts the colors seen in a movie
- **Coloring master suite** - the tool set of a colorist

Discussion Questions (2-3 mins):

- **Q:** One of the last steps in making a film is the final color adjustments. What does a colorist hope to do in this stage?
- **A:** Increase the movie’s impact on the audience, making sure the viewer’s eye looks where it's supposed to look.

Color Correction Suite: (length: 5-10 mins)

Instructions: Now it's your chance to experiment with the color correction suite. After students are nearly finished, check for understanding before moving on to the next video. Ask if any students would like to share their faces.

Exercise Prompts (2-3 mins):

- **Q:** What effects can you achieve?
- **Q:** How does the look of the image affect how it feels?

VIDEO 6: Getting to Know Dominic Glynn (length: 6 mins)

Instructions: Have everyone sit where they can see the screen. From the lesson page, play the video “Getting to Know Dominic Glynn” When the video ends, start a discussion with your group using questions below.

Discussion Questions (5-10 mins):

- **Q:** What inspired you about ?
- **Q:** Have you ever experienced an injury that made you think about life in a different way?
- **Q:** Are there any passions you have that can make a difference in the world? How?