My Many Colored Days:
Exploring Light, Color and Feelings

by Elizabeth Kerr, 2018 CTI Fellow
Bain Elementary School

This curriculum unit is recommended for:
Kindergarten through Second Grade,
Literacy and Science Education

Keywords: light, color, prism, emotions, *My Many Colored Days,* Sir Isaac Newton, color theory, Goethe, scientific process, diagram, Write to Learn

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis: This unit will integrate a study emotions and feelings with a scientific study of light and color. Students will begin by analyzing the Dr. Seuss story *My Many Colored Days,* noticing how the emotions in the book are related to colors. This study will help students to think deeply about how the author used colors to relate to feelings and actions. Students will then take an in depth look into light, why it is so important and how light can be controlled and diffracted into its component colors. Students will work with creating shadows, noting objects can be seen only when illuminated. An investigation will also be planned for students to explore with translucent, transparent and opaque materials. The cumulative lab activity in this unit will have students planning a way to use prisms to diffract light and then reconstitute diffracted light back into white light. Students will be using their science notebooks to document their progress with the lab, with a specific focus on using Write to Learn strategies. These integrated activities may be adapted for later grades.

I plan to teach this unit to approximately 21 students in my first grade class in the spring. This unit will be shared with the other grade level appropriate teachers at my school. I would like the opportunity to teach each class the lab activity in our school science lab if possible.

Introduction

As a teacher of young elementary students, I realized early on the best way to excite students about reading was to integrate reading strategies with science instruction. Nothing excites students more than discovering their world and science experiments. I find those qualities mirrored in my own experiences as an adult learner.

This particular topic interested me because of its STEAM (science, technology, engineering, math and art) applications. My first degree was in Dance Education, so I appreciate the artistic value of science and nature. These topics lend themselves well to both. Not only is it "Light is beautiful," but it is also "What is light?"

Light is something that students interact with every single day, but how often do they think about where light comes from? What would happen if there were no light? Can light be controlled? How so? Is light made of something else? How are there colors? Participating in the seminar "The Art and Chemistry of Light" led by Tom Schmedake has been such an experience in exploring light and everything that it entails. This seminar has focused on different aspects of light, how it is broken down, how it is used scientifically and symbolically.

Rationale

In this first grade specific unit, students will be studying light and color with an overarching theme based on the book *My Many Colored Days* by Dr. Seuss. I wanted to provide students opportunities to explore the world around them, even if it is something as simple as light and shadows. Younger elementary students are still amazed at and excited about everything. Studying light, color and rainbows seemed a perfect vehicle for investigating how the world works.

Also, woven through this unit will be several ways for students to incorporate "Write to Learn" strategies that will focus on guiding students' thinking through the learning process. These "Write to Learn" tasks will be simple, low-stakes tasks that will show how student understanding has grown through the unit.

Students will be performing several lab activities and working to recreate Newton's own light diffraction experiment. It is important for students to know that even as forward thinking as Newton was, it still took many times for his experiment to show his thoughts and even then, other scientists did not accept his ideas. Students will work through this activity and hopefully, see that science takes time!

On the literature side of the equation, we have our main text about color and emotions. Integrating literature with scientific studies is something I love to do and feel it provides the students a more complete learning experience. Students receive facts and instruction, but also are exposed to others' opinions and feelings on the topic. Using the science tools and ideas provided in this unit, students will create their own color and use that in their own

writing. Students will express ideas about colors and emotion and relate that to every day life.

School Demographics

Bain Elementary School is in the Charlotte-Mecklenburg School System. This system is one of the largest in North Carolina, serving approximately 146,000 students. Bain Elementary, located in the district's Southeastern Learning Community, serves approximately 945 students in grades Kindergarten through Fifth, the fourth largest elementary school in the district. Approximately 64% of the student body is Caucasian, approximately 15% African-American with approximately 20% of students as Hispanic, Asian, Pacific-Islander and other races.

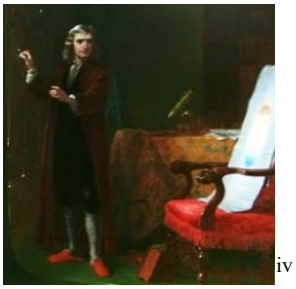
According to the 2016-2017 NC Schools Report Card for Bain Elementary, approximately 24% of students are economically disadvantaged. The school received an "A" grade in math with growth met and a "B" grade in reading with growth exceeded.[i]

I currently teach in a first grade classroom with 21 students. This unit will be integrated through literacy and science topics and taught in the spring. Standards will be based on the NC ELA standards and the Next Generation Science Standards. This unit will teach students to follow the scientific process and to think about literature critically.

Content

Light and Color: The Science Behind It

Prior to Sir Isaac Newton's prism experiments in 1666, color was thought to have been created by mixing light and darkness[ii], a theory postulated by Aristotle. Newton noticed this was in error by noticing fading print on page.[iii]

 [iv]

Through his prism experiments, Newton saw that white light could be diffracted into the visible light spectrum (commonly referred to as ROY G. BIV in elementary school). He was able to diffract light even further, to a point where the beam was monochromatic and no other wavelengths could be broken down.[v] He then stated that light was made of particles he called "corpuscles"[vi]. His theories not only impacted the scientific community, but the artistic community as well. This led to discoveries of complementary colors and the color wheel[vii].

Scientists today understand that light is energy acting as both a particle and a wave[viii]. Light impacts every aspect of daily life, from food production (photosynthesis), to energy production (photovoltaics, solar cells) to all art forms. Regardless, without light there would be no color and no life on Earth.

Light and Shadow

Webster's Dictionary defines shadow as "partial darkness or obscurity within a part of space from which rays from a source of light are cut off by an interposed opaque body[ix]." Observing how shadows change throughout the day has led to many scientific discoveries.

One of which being that the Earth is round. In 276 BCE Greek mathematician Eratosthenes first proposed the idea that he could find the circumference of the globe by measuring the shadows and the distance in two different cities.[x]

Another scientific idea based on the use of shadows were the earliest time-keeping devices. The earliest is thought to be the gnomon, a vertical rod placed into the ground, used around 3500 BCE. Later, more precise sundials were used. The position of the shadow on the face or ground helped to determine the time of day.[xi]

Yes, shadows are important and have led to many scientific discoveries, but how do they work? This is a question many young learners ask as they begin to observe and discover their world. Here we will introduce the concepts of opaque, translucent and transparent objects.

Opaque objects do not allow any light to pass through them. Therefore, when a light is shining behind an opaque object, it will cast a shadow. It is important to note to your students the size and length of the shadow, especially at different points in the day.

Translucent objects block some light and allow some light to pass through. These objects can still cast some shadows. Transparent objects allow all light to pass through. They do not cast shadows. [xii]

Light and Color: The Art Behind It

Much of the color theory used by artists today is based on Newton's work in 1666. Of course, the idea of colors and their uses has had many different interpretations since then. Some ideas behind the use of color involve the ideas of color harmony, the context in which colors are used and the color wheel. [xiii]

The color wheel shows the origin of primary, secondary and tertiary colors. Primary colors are the basis for the other two groups. These are the colors that cannot be formed by any other colors, usually thought of as red, blue and yellow.

Secondary colors are created by mixing two primary colors together. For example, mixing red and blue will create a purple hue. Green, purple and orange are secondary colors.

Tertiary colors are created by mixing one primary and one secondary color. These colors often have two word names such as "yellow-green" or "blue-green."

Moving onto the idea of color harmony. These ideas are based on how pleasing colors are to the eye. The three main components of color harmony are analogous color schemes, complementary color schemes and natural color schemes. [xiv]

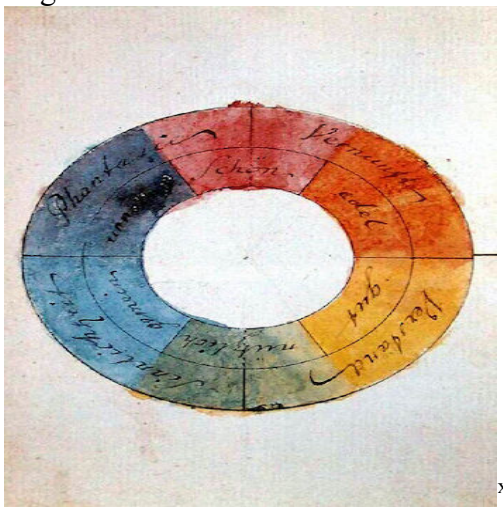
Analogous color schemes use colors that are touching on the color wheel. Usually, three colors are used. Complementary color schemes (which we will be using in this unit) are colors that are on opposing sides of the color wheel. Natural color schemes are chosen from what is seen in the world around you, whether it fits into a technical theory or not. [xv]

Color and Emotion

Johann Wolfgang von Goethe challenged Newton's scientific view of color with his own study of the physiological effects of color[xvi]. In his "Theory of Colours," Goethe took a more philosophical point of view stating that:

'Light and darkness, brightness and obscurity, or if a more general expression is preferred, light and its absence, one necessary to the production of color . . . color itself is a degree of darkness.'[xvii]

Here below you can see a version of the color wheel developed by Goethe. He added words such as "noble" and "good" to describe the colors.


[xviii]

Many people now associate colors with ideas and feelings, not necessarily in concordance with Goethe. Cooler colors are now used to promote feelings of peace and to help get the creative juices flowing. Warmer colors are said to make you want to eat![xix] As we will see with *My Many Colored Days*, different colors can influence an even wider variety of emotions.

Begin with the End in Mind: Unit Goals and Outcomes

While teaching this unit, students will:

- create a lab to diffract a beam of white light and reconstitute the light.
- draw a diagram to explain their work.
- create a positive/negative space artwork using shadows and objects placed in the light.
- create a watercolor image using the color wheel and complementary colors.

After teaching this unit, students should understand:

- That objects in darkness can only be seen when illuminated.[xx]
- That light can be controlled by placing objects in its path.[xxi]
- That light and color are scientific concepts that artists use to express ideas.[xxii]

The Plan: Instructional Implementation

Materials needed to implement this unit are as follows:

- chart paper
- *My Many Colored Days* by Dr. Seuss
- Light Labs Optical Kit
- flashlights
- blank CDs
- plain white paper
- small squares of colored cellophane (use different colors)
- black and white construction paper
- opaque materials (wooden blocks, chairs)
- translucent materials
- transparent materials (glass bottle, clear transparency)
- watercolor paints and paintbrushes
- boy and girl shapes
- color wheel
- science notebooks or journals
- index cards to use for vocabulary words
- any other age-appropriate texts on light or using colors as feelings (Epic! Online Library is a great resource and is free for educators).

Day One: Introduction to Light and Color

Explore

Introduce students to topic. Read *My Many Colored Days*. Ask students to think and respond to the text. "Why do you think we read this book?" "What do you think this has to do with light?" "What do you think about the colors mentioned in the story?" "How do some of these colors make you feel?" "How do we see color?" "How does light make you feel?"

Learn

Create two anchor charts, one for light and one for color. Students should take 5 minutes to record their ideas about light and color in their science notebooks (Write to Learn Strategy). Then, work with students to come up with working definitions of what light and color are. Note specifically that light is made of **energy (usable power that allows things to be active[xxiii])**. Discuss what **energy** is. Have students complete a vocabulary flip-card for the word "Energy" in their science notebooks. Record their ideas on the anchor charts and place charts where they can be easily accessed through the unit. This is your working definition and at the conclusion of each activity, this should be reviewed and edited. Review definitions of light and color.

Next, read the first section of *Light* by Carolyn Bernhardt (available on Epic! Online Library). This is a basic definition of light for students. Students should discuss with each other where they see light. What is the difference between natural light and man-made light? What does light let us do? Read page 10 of *Light*.

Light is made of energy. Light travels in waves, like the ocean. Some waves are shorter. These help us to see colors like blues and purples. Longer waves help us to see reds and oranges[xxiv]. Ask students to discuss with a partner what they think will happen if all of the waves mix together (white light is created). Read page 11. Discuss sunlight. Reflect on what this means for how we see color. Continue to read Light and Color section.

Apply

Now, you have read about reflection and absorption. Pick an object in the classroom, a blue chair for example. Have students discuss with each other why the chair appears to be blue (blue light is being reflected, all other colors are being absorbed). Students should create vocabulary cards for reflect (bounces back waves of light or sound[xxv]) and absorb (takes in waves of light and sound[xxvi]). Ask students if the person in My Many Colored Days is reflecting or absorbing the colors as an open-ended discussion question.

Assess

Have students complete an Exit Ticket similar to Appendix 2, Day One. Review questions and pull strategy groups, if needed. Use this baseline activity as a pre-assessment.

Day Two: Investigating Opaque, Translucent and Transparent Materials

Explore

Refer back to previous work. Review vocabulary words: energy, reflect, absorb. Next, put students in groups of 3 to 4. Give them a selection of opaque, translucent and transparent materials. Direct students to shine flashlights on each of objects from all sides. Have them record their observations in their notebooks. You may even take students outside to a quiet area to let them experiment with objects in the sunlight.

Learn

Bring students together to discuss the results of their exploration. What did they notice about each material? You will need to make certain students are making the connection that objects cast shadows. Read pages 16-19 of *Light* by Carolyn Bernhardt. Introduce vocabulary words opaque, translucent and transparent. Define for students. Have students use index cards to create vocabulary cards for these words.

Apply

Next, have students take the objects that they were working with earlier and have them sort the objects into three groups: opaque, translucent and transparent. Allow students to check their work with flashlights to make sure.

Add this information to the Anchor Chart: Light can pass through some objects. Other objects block light completely.

Assess

Have student groups think about these problems (also available in Appendix 2, Day Two):

- A person wants to build a house that lets in a lot of sunlight. Which type of material should he use?
- This person works at night and needs to sleep during the daytime. She needs help! Which material should she use to help keep her room dark so she can sleep?
- The next person is making an art project to hang in the window. Some light will travel through colorful squares of tissue paper. He is using _____ materials.

Check student answers and pull for strategy groups if needed.

Day Three: Making Shadows and Controlling Light

Explore

Review opaque, translucent and transparent from previous session. Discuss which objects created shadows and how. Now, students are going to use that knowledge to solve a shadow puzzle.

Place outside several objects that different sizes and different shapes. Mark on some of the objects with a star sticker where light should shine on the object. The other areas of the objects should be cast into shadow. Provide the objects used from the previous investigation. Hopefully, using opaque materials (such as building blocks, geoblocks, etc.) students should build structures that allow the starred part of the object to be illuminated and the other parts cast into shadow. Discuss with students how they are controlling the path of light.

Learn

Gather students together to discuss investigation. Ask about the difficulty of lighting up only a part of an object. Discuss what types of materials they used to block the light on the shadowed part of the object. Remind students that one way to control light is to place objects in the path of the light.

Apply

Complete the same exploration using flashlights in the classroom. Also, have students move the flashlights around the object. Does their structure work the same way when the light is coming from a different direction? Discuss. Students should take about 5 minutes to record their ideas in their science notebooks. Teachers may wish to connect this to the sun moving across the sky and how shadows would appear differently at different times of the day.

Add this information to the Anchor Chart: Light can be controlled by placing objects in its path.

Assess

If iPads are available, have students photograph their work and explain how they controlled the path of light to only illuminate part of an object. Discuss photographs at the conclusion of this activity.

Day Four: Finding the Colors of the Rainbow

Explore

Give students white paper, flashlights and CDs. In groups, students should work to use the light from the flashlights and the CDs to make a rainbow on the white paper (for another version of this activity, click here[xxvii]). Ask students to record their observations in their science notebooks.

Learn

Gather students together to discuss what they observed during this activity. White light from the flashlight landed on the surface of the CD and something happened! The light was separated into the colors or wavelengths that we can see. This is called the color spectrum, or a rainbow.

Apply

Now, that students have separated white light into the separate visible colors, is it possible to put it back together again? Sir Isaac Newton thought so. He experimented with light and color back in the 1600's. The students are working to recreate one of his experiments today.

*In this session, students are going to be visiting stations. This will enable the instructor to monitor the use of the light box and prisms carefully.

Station 1 – Interactive Lab using the activity found here[xxviii]. Students are working independently. See Appendix 2 for Appropriate Task Card.

Station 2 – Literacy and Research – Students will research light and color ideas using Epic! Online Library. I have a collection of books and videos preselected (you may search Mrs. Kerr or Light and Color collections). Students are working independently. See Appendix 2 for appropriate Task Card.

Station 3 – Teacher Led Station – using the Light and Optics Kit students will work to recreate Newton's light diffraction experiment.

Explore with students the idea of what happens when a focused beam of light travels through a prism (the light is separated into the visible color spectrum). Pose the question, "Is it possible to take the rainbow and make it into white light again?" Lead students into exploring with the prisms and the placement of the prisms until the desired result is achieved. This separation of light is called diffraction. Have students use an index card to illustrate this vocabulary word. Then, have each group draw a diagram of their experiment to record their results.

Add this information to the Anchor Chart: Light can be separated into colors that we can see. We see a rainbow, ROY-G-BIV. Light can also mix back together to make white light again.

Assess

Review with class the main experiment for today. Use rubric found in Appendix 2 to assess students' diagrams in their notebooks.

Day Five: Colors and Feelings!

Explore

Review previous work. Now, students are ready to dive into the expressive side of color. Show the emotion cards in Appendix 2, Day 5. Use Post-It Notes to cover the emotion listed on the card. Remind students how Dr. Seuss used colors in *My Many Colored Days* to show emotions and feelings. With their Turn and Talk partners, students should analyze each card. Students will determine what emotion is being expressed and, then, what color they think should be associated with that emotion.

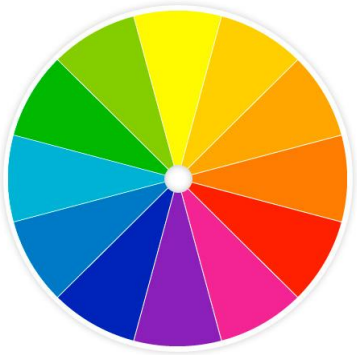
Learn

What are emotions? What kinds of things affect your feelings? Reread *My Many Colored Days.* Have students predict what they think is making the narrator feel that particular emotion right then.

Discuss how colors can affect your emotions. Talk with students about how different colors make you feel.

Apply

Students are now going to complete complementary color watercolor painting using the Color Wheel. Show students the Color Wheel.



Explain that students should pick a color to use for this assignment. This color should relate an emotion to them, it should make them feel a certain way. Students will paint their respective person shape this color.

Next, using the Color Wheel, students will find the color complementary to their first chosen color. Complementary colors are very vibrant and create the most contrast in a color scheme. This is color opposite the chosen color on the Color Wheel. The students will paint a background using the complementary color.

The last part of this assignment is a writing task. Now, students will work to write about the emotion and color that they have chosen to work with. Students will create at least one sentence describing how they feel when they are their chosen color. For example:

"When I feel blue, I feel joyful! I want to laugh and smile."
"When I feel red, I feel so angry. I want to stomp my feet and scream!"

Assess

See the rubric for this assignment in Appendix 2, Day Five.

Day Six, Inventing Your Own Colors

Explore

Review with students the work from the previous sessions. Now, students will work with flashlights and colored cellophane filters to create a new color. Show students how to use rubber bands to attach the cellophane to the end of the flashlight. Allow students to explore with several filters. Students should have about 5 minutes at the conclusion of the exploration to record any observations in any way they see fit.

Learn

Students were exposed in the previous session to the color wheel. Show this again. Direct attention to the primary colors on the color wheel. Then, note how secondary colors are made (mixing 2 primary colors together). In this session, students will use different filters to come up with a "formula" for a new color and think critically about how this color make them feel.

Apply

Give students flashlights and cellophane color filters. Explain how to write the "formula" for their new color, i.e. 1 red + 2 blue = (new name for their color). Have students observe what happens when too many filters are used (the light is obscured). Have a chart prepared to record all of the color formulas that the students create. At the end of the session, have a light show to display all of the new colors!

Assess

See Appendix 2, Day Six for the final assessment of this unit.

Appendix 1: Implementing Teaching Standards

Teaching Standards Addressed in this Unit

Day One

CCR Anchor Standard RL.4 – Interpret words and phrases as they are used in a text and analyze how specific word choices shape meaning or tone.

NC ELA RL.K.4 With prompting and support, ask and answer questions about words in a text that suggest feelings or appeal to the senses.

NC ELA RL.1.4 Identify words and phrases in stories or poems that suggest feelings or appeal to the senses.

The main focus of this unit is for first grade, but applicable standards are listed for Kindergarten.

Day Two

NC ELA RI.K.1 With prompting and support, ask and answer questions about key details in a text.

NC ELA RI.1.1 Ask and answer questions about key details in a text.

NC ELA RI.2.1 Ask and answer such questions as who, what, where, when, why, and how to demonstrate understanding of key details in a text.

NC ELA RI.K.2 With prompting and support, identify the main topic and retell key details of a text.

NC ELA RI.1.2 Identify the main topic and retell key details of a text.

NC ELA RI.2.2 Identify the main topic of a multi-paragraph text as well as the focus of specific paragraphs within the text.

The main focus of this unit is for first grade, but applicable standards are listed for Kindergarten and Second Grade.

Day Three

Next Generation Science Standards[xxix] (NGSS)

1-PS4-2 Waves and Their Applications in Technologies for Information Transfer

Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated. Performance Expectation Grade: K-2, 1

1-PS4-3 Waves and Their Applications in Technologies for Information Transfer

Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light. Performance Expectation Grade: K-2, 1

Day Four

NC ELA CCR Anchor Standard W.5 – Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.

NC ELA W.K.5 Participate in shared investigation of grade appropriate topics and writing projects.

NC ELA W.1.5 Participate in shared research and writing projects.

NC ELA W.2.5 Participate in shared research and writing projects.

The main focus of this unit is for first grade, but applicable standards are listed for Kindergarten and Second Grade.

Day Five

CCR Anchor Standard RL.4 – Interpret words and phrases as they are used in a text and analyze how specific word choices shape meaning or tone.

NC ELA RL.K.4 With prompting and support, ask and answer questions about words in a text that suggest feelings or appeal to the senses.

NC ELA RL.1.4 Identify words and phrases in stories or poems that suggest feelings or appeal to the senses.

The main focus of this unit is for first grade, but applicable standards are listed for Kindergarten.

Appendix 2

Day One Exit Ticket

Name:_____

1. What is light made of?

2. What does energy do?

3. Think of your favorite color. How does it make you feel?

Day Two Exit Ticket

Name:_____

Translucent, Transparent, Opaque

1. A person wants to build a house that lets in a lot of sunlight. Which type of material should he use?

   transparent translucent opaque

2. This person works at night and needs to sleep during the daytime. She needs help! Which material should she use to help keep her room dark so she can sleep?

   transparent translucent opaque

3. The next person is making an art project to hang in the window. Some light will travel through colorful squares of tissue paper. He is using _____ materials.

   transparent translucent opaque

Day Four

Interactive Lab Task Card

Name:_____

Light and Shadows

1. **What type of object made the best shadows?**

   transparent translucent opaque

2. **When were the objects' shadows the shortest?**
   - about noon
   - early morning
   - at sunset

3. **Why do shadows made by the sun move through the day?**
   - because the object is moving
   - because the sun appears to move through the sky
   - because the ground is moving

Reading and Research Task Card

Name:_____

Light and Color, Epic! Online Library

Read at least three books in this collection (remember that I can see your progress!). Write down three interesting facts you found from your reading.

1. _____

_____

2. _____

_____

3. _____

_____

Rubric for Assessing Science Notebook Diagrams

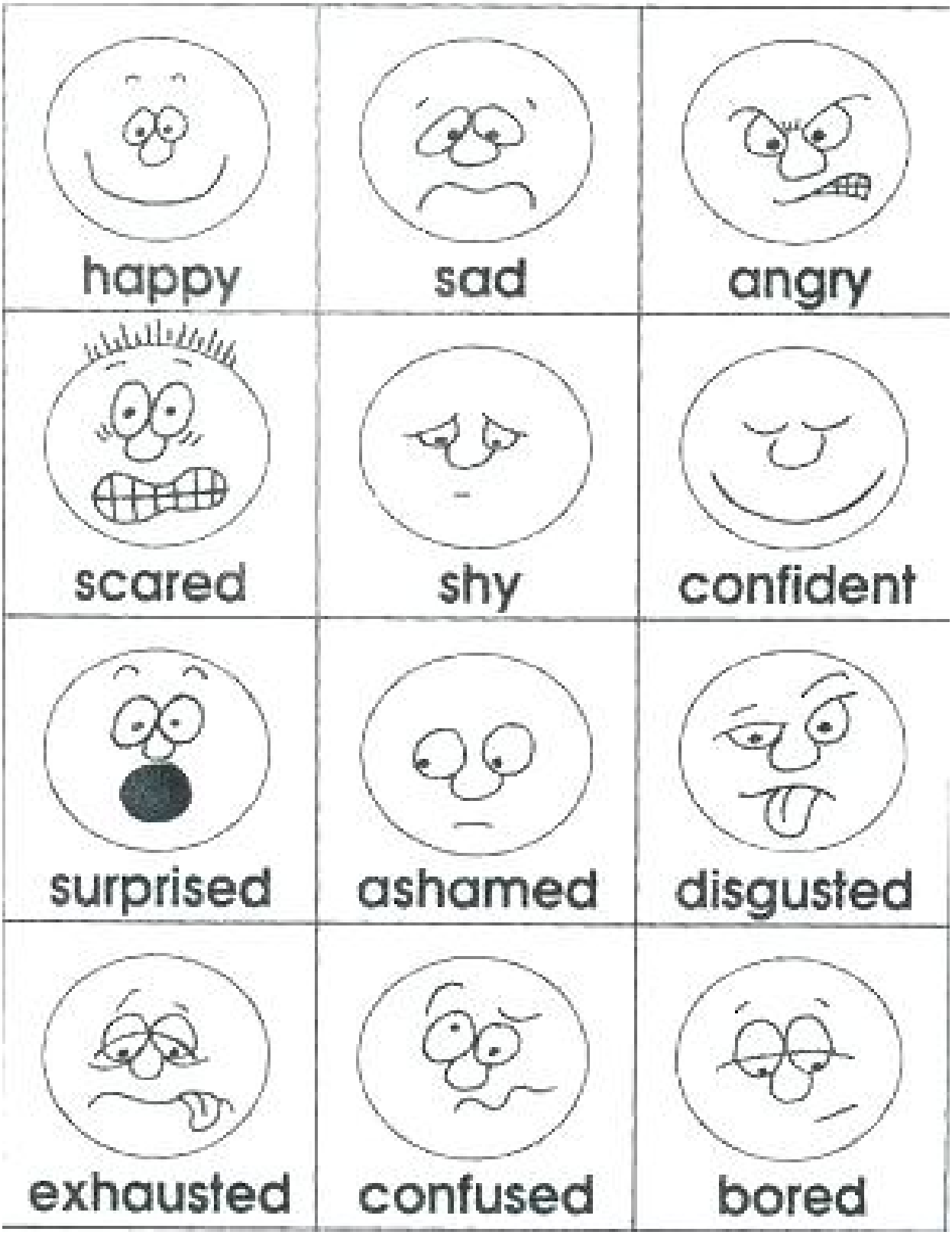
Student drew the basic outline of the experiment.	
Student used color in their work.	
Student used arrows to show what was happening in the experiment.	
Student worked neatly and showed their best effort.	

Day Five

Student Writing and Art Sample Rubric

Student used complementary colors in their watercolor painting.	
Student used an emotion and a corresponding color in their writing.	
Student worked neatly.	

Emotion Cards[xxx]



Day Six

Final Assessment

Name:_____

Light and Color

1. Why is light important?
   - Light allows us to see the things around us and gives us colors.
   - Light is pretty.
   - Light makes shadows.

2. An object that is _____ lets light travel clearly through it.
   - transparent
   - translucent
   - opaque

3. An object that is _____ does not let light pass through at all.
   - transparent
   - translucent
   - opaque

4. What does energy allow you to do?

_____

_____

5. How do you make a shadow?

_____

_____

6. Describe what happens to a beam of light when it passes through a prism.

_____

_____

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