WE ALL HAVE A HAND IN STUDENT SUCCESS!

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#allinWVPB
Facilitator Notes:

These lessons are a part of a series. They are designed to be used as stand-alone lessons or as a series of lessons.

Each session can take as little as 45 minutes to complete or be extended for a longer time period.

It is designed to be implemented with limited materials.

Lessons contain digital media clips and will need internet access and ability to show content to participants.

The lessons are suitable for multiple age levels.

Tasks can be easily modified.

The series will enhance a variety of programs such as: after-school networks, school community nights, grand-families, library events, or other community events where children are engaged. They may also be used by parents or caregivers looking to supplement a project.

The lessons are designed to capture the children’s attention and motivate them to learn with an intentional purpose.

Extension activities are included to encourage family learning at home.

Lessons are user-friendly and step by step directions are provided.

If you are interested in more information about our resources, please feel free to contact us at education@wvpublic.org
Create Zany Portraits
Learn About Lines and Shapes!

Art Grades K-5

Materials Needed
- Computer, projector and internet access for the video at https://wv.pbslearningmedia.org/resource/1b8214a0-a716-4868-b424-a99ab329310e/zany-portraits-in-the-style-of-charly-hamilton/
- Blank white paper 8 ½ x 11” – enough for each student
- Copies of pre-drawn character outlines - enough for each student
- Pencils
- Black markers
- Assorted colored markers/crayons/colored pencils
- A copy of the Take-home Handout for each student

Introduction
1. Show the students “posters” with the vocabulary terms and examples of each line and shape, talk about each one and ask students to find examples of each in the room.
2. Watch the video to learn about the art of Charly Hamilton and how to create art in his style.
3. Talk about what kinds of lines he used in his work.

Activity
4. Give each student a blank sheet of white paper OR a page with character outlines already drawn, a black marker, and assorted colored markers of their choice.
5. If student chooses a blank piece of paper, they now use a pencil to draw the outline of two characters then trace the outline with a black marker.
6. Have students use a highlighter to color the large spaces inside their pictures.
7. Have students use bright colors to add lines, designs, and textures to their characters in the style of Charly Hamilton.
8. If time permits add lines, designs, and textures to their backgrounds.

Follow-Up – Take-Home
9. Have students share their art with each other and discuss the types of lines they used and why.
10. Give each student the Sharing What I Learned handout and ask them to share their portrait and to complete their handout with a grandparent.
<table>
<thead>
<tr>
<th>Types of Lines</th>
<th>Short</th>
<th>Repeated</th>
<th>Thick</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td><img src="image" alt="Thick Line" /></td>
</tr>
<tr>
<td>Long</td>
<td><img src="image" alt="Long Thin Straight Line" /></td>
<td><img src="image" alt="Long Thin Curvy Line" /></td>
<td><img src="image" alt="Long Thick Straight Line" /></td>
</tr>
<tr>
<td>Dotted</td>
<td><img src="image" alt="Dotted Line" /></td>
<td><img src="image" alt="Curvy Line" /></td>
<td><img src="image" alt="Zig Zag" /></td>
</tr>
<tr>
<td>Triangle</td>
<td><img src="image" alt="Triangle" /></td>
<td><img src="image" alt="Square" /></td>
<td><img src="image" alt="Circle" /></td>
</tr>
</tbody>
</table>
Zany Portraits – Take Home

On your own or with the help of a parent or family member complete this sheet to show what you have learned. Read each word aloud, draw a picture to show the meaning of the word, and find a real example of the word in your home.

<table>
<thead>
<tr>
<th>Artist Word</th>
<th>My Drawing</th>
<th>Where I See It In My Home</th>
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</thead>
<tbody>
<tr>
<td>Short</td>
<td></td>
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<tr>
<td>Long</td>
<td></td>
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<tr>
<td>Dotted</td>
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<td>Triangle</td>
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<td>Square</td>
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<td>Circle</td>
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<td>Repeated</td>
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<td>Thick</td>
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<td>Thin</td>
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<td>Straight</td>
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<td>Curvy</td>
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<tr>
<td>Zigzag</td>
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</tbody>
</table>
STEM Engineering and Rockets This lesson is part of the Curious George STEM Collection in PBS LearningMedia STEM K-2

Materials Needed:
- Computer, projector and internet access for the video: CuriousGeorge:
  - Blast Off
  - Space Monkey Blast Off! handouts, folded in half (attached) Scissors
  - Straws (for each child: one wide, cut into thirds; one thinner straw, full length) Tape
  - Paper clips

Prep
1. Step 1: Using the “Space Monkey Blast Off!” handout, build your own rocket to anticipate where and how children may need guidance. (see Supplies)
2. Step 2: Arrange to have assistant(s) who can help children assemble their rockets.
Be sure you have straws of two different diameters. The wider straw should fit smoothly over the narrower one. Cut out one Curious George rocket for each child ahead of time.

Activity
1. Watch the video. CuriousGeorge: Blast Off (PBS LearningMedia)
Before the children watch, ask them to notice what happens just before the launch of the rocket. What is special about the way the scientists count? You may want to preview vocabulary words such as ignition, orbit, rocket, and International Space Station. Then, play the video Curious George: Blast Off!
2. Step 2. Introduce the activity.
Tell children they’ll be building a rocket that is powered by air. Invite them to name other things that are also moved by air (e.g., kites, windmills, sailboats, leaves, flags, wind chimes). Ask for a volunteer to demonstrate how to launch the rocket, using one you’ve built ahead of time.
3. Build and launch rockets. [Note: Tell children to point their rockets away from people before launching.]
Help children build their rockets, following the instructions on the handout (Steps 1 and 2). Ask children: What makes your rocket launch? What happens if you blow hard into the straw? What if you blow gently? How can you make your rocket go higher? (Angle it upwards.) How can you make the rocket go farther? (Launch it horizontally.)
As the children work, circulate to watch, listen, and engage children in conversations. If a rocket isn’t launching, ask why that may be the case.

To help fix the rocket, check that the straw’s flattened end is tightly sealed with tape so that no air escapes.

1. Test and evaluate

Have children change their rocket designs by adding a paper clip to the top of it (Step 3).

Have them test the rocket with and without the paper clip.

Ask: Which design flies the best? Why was testing important? What does testing help you discover about your rocket?

**Extend with Books**

Encourage children to use these books as they continue to learn about rockets.

*Curious George and the Rocket* by H. A. Rey (Houghton Mifflin Harcourt 2001). Curious George becomes the first space monkey!

*Roaring Rockets* by Tony Mitten (Kingfisher, 2000). Join an animal crew as they launch into space.

*Rockets and Spaceships* by Karen Wallace (DK, 2011).

Photos and pictures explain the basics of space travel.
Observation Sheet
Record results of the flights you conducted and modifications you made to your rocket.

<table>
<thead>
<tr>
<th>Flight pattern: straight or crooked</th>
<th>Height:</th>
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<tbody>
<tr>
<td>Rocket without paper clip</td>
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<tr>
<td>Rocket with paper clip</td>
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<tr>
<td>Other modifications</td>
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Why do you think things were different or the same?
Never Give Up!
The Wright Brothers and Designing Airplanes

STEM K-5

Materials Needed

- Computer, projector and internet to access the video https://pbskids.org/video/xavier-riddle-and-secret-museum/3035055703
- Plain paper to make airplanes
- Paper Glider Directions for the students who may need assistance in making a plane
- Painters or masking tape – something easy to remove from the floor
- Yard stick or tape measure
- Handout to record distance
- Crayons, colored pencils, or markers

Prep

- Make copies of Paper Glider Instructions
- Measure 5 foot intervals on the floor which will be used to see how far each paper airplane will fly. Use the tape to mark each interval

Activity

1. Ask students to give examples of when it took them more than one try to learn how to do something.
2. Ask students why they think it is important to “never give up” on something.
3. Show the Xavier Riddle video on the Wright Brothers. You should stop the video at the 11:30 point.
4. Talk about what Xavier, Yadena, and Brad learned from the Wright Brothers.
5. Discuss what the students know about making paper airplanes.
6. Give them paper to make their own airplane.
7. If they know how to do this they may want plain paper
8. If they are new to paper airplanes they may want a paper with instructions
9. Allow each student to make a plane and decorate it if they want to.
Wright Brothers (continued)

Give each student a copy of the “Flight Distance Table” and a pencil or marker, take turns flying the planes and recording the distance it travelled on the table. Discuss what they would change about their plane to make it go farther, straighter, etc.

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<thead>
<tr>
<th>Flight</th>
<th>Design Features</th>
<th>Distance Traveled</th>
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<tbody>
<tr>
<td>1</td>
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<td>4</td>
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</tbody>
</table>

How was your experience in making a paper airplane? What worked well? What didn’t work well? What would you change to make your plane fly a greater distance?
### Wright Brothers - Extension

Have students make alterations to their airplanes, record alterations. E.g. change the wing design, add extra folds, tape pennies to the wing for added weight, change where you place weights, tear slits in the wings. Only make one alteration per flight.

Examine the data, what is your optimal design? Can you combine several changes to make the best flyer? Do any of these changes make a difference in flight?

<table>
<thead>
<tr>
<th>Flight</th>
<th>Design Features</th>
<th>Distance Traveled</th>
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</thead>
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<tr>
<td>4</td>
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</tbody>
</table>

How was your experience in making a paper airplane? What worked well? What didn’t work well? What would you change to make your plane fly a greater distance?
## Paper Glider Directions

1. Fold down upper two corners.

   ![Fold down upper two corners](image1)

2. Fold Paper in half-length wise.

   ![Fold paper in half-length wise](image2)

3. Take outer two corners and fold like this:

   ![Take outer two corners and fold like this](image3)

4. Your glider should look like this.

   ![Your glider should look like this](image4)
Note: There are two lessons provided in this activity, both are focused on getting children to increase their movement. The first lesson coordinates movement with counting while the second puts weather and interpretive movement together.

Materials Needed

**Counting Cards Activity**
- Poster board with corresponding “suites” and exercises or copy of the list at the end of these instructions
- Deck of cards
- Computer, projector, and internet to access the video
- Deck of Cards [https://wv.pbslearningmedia.org/resource/d09d166e-f5af-47de-9709-608317886536/active-deck-of-cards/](https://wv.pbslearningmedia.org/resource/d09d166e-f5af-47de-9709-608317886536/active-deck-of-cards/)

Activity

1. Show the students the “poster” with the names of the suites of cards and type of exercise associated with each suite.
2. Show the students the video and have them exercise along with the students they are watching.
3. Review the activity rules with the students.
4. Students then take turns drawing a card from the deck and leading the group in the correct exercise and number of repetitions.
Kids in Motion (continued)
Movement Using Counting and Weather

In this video and activity students learn a variety of fitness activities in which they depict the weather through movement. Students may take turns being the “meteorologist” and leading the class in the exercises.

Materials Needed

Weather Fitness Activity
- Poster board with list of weather related terms found at the end of these instructions
- Computer, projector, and internet to access the video

Activity

1. Ask students if they know what a meteorologist does? Explain that a meteorologist studies the weather. They use specific terms to help people understand the current weather and try to predict future weather.
2. Discuss the meaning of the weather-related terms on the list. Ask students to explain what each kind of weather looks like and what it sounds like.
3. Show the video and have students participate in the exercises as they watch.
4. Have students take turns being a “meteorologist” and choosing what weather to illustrate.
5. Ask students if there are any weather terms that are missing from the list (fog, sleet, etc.)
6. Add them to the list and have students create an exercise for each.

Follow-up Take-Home

- Have students name their favorite exercise from the Deck of Cards Activity. How will they explain the activity to their family?
- Give each student the Sharing What I Learned handout and ask them to complete it with a family member.
# Counting Cards Activity

<table>
<thead>
<tr>
<th>Hearts</th>
<th>Star Jumps</th>
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<table>
<thead>
<tr>
<th>Spades</th>
<th>Ski Jumps</th>
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<thead>
<tr>
<th>Diamonds</th>
<th>Push-ups</th>
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<table>
<thead>
<tr>
<th>Clubs</th>
<th>Swimmers</th>
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</tbody>
</table>

King, Queen, and Jack are 11 repetitions  
Ace is 15 repetitions  
Number Cards are that number repetitions
<table>
<thead>
<tr>
<th>Weather</th>
<th>Picture</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain</td>
<td><img src="Image" alt="Umbrella" /></td>
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</tr>
<tr>
<td>Snow</td>
<td><img src="Image" alt="Snow Trees" /></td>
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<tr>
<td>Wind</td>
<td><img src="Image" alt="Wind Blow" /></td>
<td></td>
</tr>
<tr>
<td>Sun</td>
<td><img src="Image" alt="Sun" /></td>
<td></td>
</tr>
<tr>
<td>Thunder &amp; Lightning</td>
<td><img src="Image" alt="Lightning Bolt" /></td>
<td></td>
</tr>
<tr>
<td>Weather Term</td>
<td>What does it look like?</td>
<td>What does it sound like?</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Rain</td>
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<tr>
<td>Snow</td>
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<tr>
<td>Thunder</td>
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<tr>
<td>Lightning</td>
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<tr>
<td>Sun</td>
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<tr>
<td>Clouds</td>
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<td></td>
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<tr>
<td>Wind</td>
<td></td>
<td></td>
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<tr>
<td>Tornado</td>
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<tr>
<td>Rainbow</td>
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</tbody>
</table>
My Food Plate – Are you a Picky Eater?

Health K-2

Materials Needed

• Computer, projector and internet to access video
• Copy of “My Food Plate – Food Group Sorting” handout for each student
• Copies of “5 Food Groups” pictures for each student
• Scissors/glue
• Markers/crayons
• Small plates or coffee filters, various foods for taste test

Activity: The Picky Eater!

1. Show students the video D.W. the Picky Eater https://pbskids.org/arthur/health/nutrition/episode.html
2. Discuss: What is a picky eater? Do you know a picky eater? Are you a picky eater?
3. How do you feel when you try new foods?
4. Why is it important to try new foods?
5. Begin a discussion of what foods are good for you and what foods are not very good for you.

(Note) you might have to adjust for allergies: Wash hands first!
Provide food for students to try, have them try the foods and record their reactions.
Some food suggestions:

Fruit: grapes/banana slices
Grain: crackers
Protein: nuts/sunflower seeds
Dairy: cheese cubes
Vegetable: baby carrot
Activity: The 5 Food Groups

1. Ask students to tell you what they think are “healthy foods” and why. What about things like chips and candy? These are occasional foods that need to be taken in moderation.

2. Students view the video Portions: My Food Plate and talk about what they learned. [https://wv.pbslearningmedia.org/resource/6aa3584b-7960-4e4f-962f-6e16ef1d4bc1/abra-312-portions-my-food-plate/]

3. Have students pair up and ask them to brainstorm foods in particular food groups. (see hand out)

4. Give each student a copy of “My Food Plate” and explain that in order to be healthy we need to balance the foods we eat to include something from each section each day.

5. Explain each term found on the plate – vegetables, grains, protein, dairy, fruit.

6. Give each student a copy of the handout with pictures of different foods. Have students look at the pictures of the food. Talk about each individually (what foods do they see. Work with students to name each item on the page, color it appropriately, and then cut them apart.

7. Guide students in placing the picture on the correct group of their plate. Repeat until all food pictures are placed. Have students glue the food tiles onto their plates. Discuss which of their favorite foods are missing and which group would they join.

Challenge them to share their work when they get home. Encourage them to host a taste test for their family.

If time permits, explain that exercise and good nutrition go together. Take the cards from Kids in Motion and go through a series of exercises.
Work with a partner to brainstorm foods that belong in the various food groups, how many can you think of?

<table>
<thead>
<tr>
<th>fruit</th>
<th>protein</th>
<th>grains</th>
<th>dairy</th>
<th>vegetable</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Fruit" /></td>
<td><img src="image2.png" alt="Protein" /></td>
<td><img src="image3.png" alt="Grains" /></td>
<td><img src="image4.png" alt="Dairy" /></td>
<td><img src="image5.png" alt="Vegetable" /></td>
</tr>
</tbody>
</table>
If you try lots of different foods, you might find something that’s grr-ific!

Try out foods from each group:

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Vegetable</th>
<th>Protein</th>
<th>Grain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yum!</td>
<td>Yum!</td>
<td>Yum!</td>
<td>Yum!</td>
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<tr>
<td></td>
<td>Not So Good</td>
<td>Not So Good</td>
<td>Not So Good</td>
</tr>
</tbody>
</table>

Talk about the foods you tried. For each food you tried, circle the picture of the face that shows if you thought it was yummy or not so good.

Find more games and activities at pbskids.org

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Food Group Sorting

- Protein
- Grains
- Fruit
Objects and Light
Peep and the Big Wide World
Science K-5

Materials Needed

- Precomputer, projector and internet to access video Peep and the Big Wide World
  https://www.pbslearningmedia.org/resource/buack2-sci-ilnightlightvideo/night-light-video/
- dot stickers
- opaque objects
- flashlights
- medium-size mirror
- recording sheets, writing utensils
- various reflective objects (such as: foil sequins, pan spoon, sheet of metal, etc.)

Prep

- Label an empty wall or area in the room with a “Light Investigators” sign so that students can display their light investigation recording sheets after the activity and their individual observations.
- In the same area, create a “Light investigators Observation Station” that includes light resources and objects made of reflective and other materials so students can explore how light responds to different materials on their own or with a partner.

Activity 1

1. Begin discussing the meaning of light
   Ask students the following questions:
   Have you ever imagined what your life would be like without light? Driving to school without light? Using a cell phone or reading a book at night without light? Tell students they are going to watch a short video about Peep and Quack. Peep can not see anything because it is too dark. This video will show us how light interacts with reflective materials and how objects require light to be seen.
2. Show the video clip Peep and the Big Wide World: Night Light
3. Explain to students they will be exploring today and investigating what happens when a light beam hits an object with a smooth, shiny surface.

4. Use the handout for students to record their findings.

5. Draw attention to an opaque object, such as a book. Have students predict what will happen when a flashlight shines on the book. It will cast a shadow on the other side of the book, it absorbs the light, etc. Shine the light on the book. Follow up with a brief discussion on student predictions.

6. Then ask: What do you think will happen when the light beam hits the spoon? Shine the light on the spoon. Discuss predictions and have students compare how light responded to the book and the spoon.

7. Move the spoon around in the path of light. Have students talk about how light can change direction when it hits a reflective material. Have them compare it to how the light responded when it hit the book.

8. Ask a student to hold up a mirror and one student hold the flashlight. What do you think will happen when the light beam hits the mirror? Darken the room and carry out the activity. Discuss student predictions. Place a dot sticker where the light beam appears on the wall.

9. Ask questions such as: Where did the light start? What happened when the light hit the mirror? Why do you think that is? Did the light respond the same way when it hit the book? The spoon?

10. Have the student holding the flashlight go to the opposite side of the room. Ask: What do you think will happen to the light beam when it shines on the mirror now? Encourage students to place a dot sticker on the wall where they think the light will appear. Carry out the activity.

11. Discuss predictions. Ask: Why did the light beam hit the wall at a different place? (It hit the mirror at a different angle.)

12. Finally, have students work with a partner or in a small group to explore what happens when they move the mirror around. Challenge students to reflect the light to make the beam shine on the dot sticker that they put on the wall earlier.

**Discussion Questions**

What happens when light hits a mirror?

How is light hitting a book the same or different?

Why can you often see things in a dark space?

Did the video make you think differently about what happens when light enters a space and hits different objects? How?

Do you have other questions about how light responds to different materials? Work with students to help them think of ways to find answers to their questions.
Activity 2 (Optional or home extension)

Materials needed
- chalk
- chart or recording paper
- compass
- cell-phone camera for documenting observations (optional)

Activity 2
1. Begin by showing the short video clip Shadow Tracing
2. Explain that students will be working with a partner to trace each other’s shadow. Explore how the Sun’s position in the sky affects the shadows on the ground. Ask students why they think shadows on the ground might change in size, shape, or direction.
3. Take students outside to the designated area. Have the shadow maker stand still while their partner draws their shadow. Switch places so each student has a turn.
4. Stimulate discussions during this activity with questions such as:
5. How do you know where the Sun is in the sky when you look at the direction of your shadow?
6. Do you think the shadow will be in a different place at different times during the day?
7. Why do you think that is?
8. At what time of day would your shadow the shortest? Longest? Why do you think that is?

Discussion Questions
What happened when the boy in the video moved his hand closer to the light source? Why do you think that happened?
At what time of day would you anticipate outdoor shadows the shortest? Longest? Explain why that is.
How can shadows on the ground tell you where the Sun is in the sky?
What do you think will happen to a shadow when the Sun goes down in the sky?
Do you have any other questions about how light affects shadows?
Did the video make you think differently about how the Sun and shadows are connected?
# Objects and Light Observations

<table>
<thead>
<tr>
<th>Object</th>
<th>Prediction</th>
<th>Observation</th>
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Objects and Light Extension

Note - Schedule the activity on a sunny day. Repeat the activity in the morning, at midday, and in the afternoon. Find a safe, clean, large sunny area with a smooth surface outside to carry out the activity. Allow enough room for students to spread out as they trace one another’s shadows on the ground. You might plan to take photos as pairs work together. Create a Shadow Wall in the classroom for students to visit and to add to throughout your full light unit. Each time students go outside for an observation, alert them not to look directly at the Sun because it can harm their eyes. Pair students. Let them decide who will be the shadow maker and who will be the shadow tracer.

Trace My Shadow!

Summary: Students go outside to the same location a few times during the day to trace a partner’s shadow and observe the relationship between the Sun and shadows on Earth’s surface.

Activity type: Outdoor activity
Activity time: 30 minutes (three observations lasting 10 minutes each)

Materials Needed
- Chalk
- Chart or recording paper
- Cell-phone camera for documenting observations (optional)

Activity

• Explain to your child you will be working as partners to explore how the Sun’s position in the sky affects the shadows on the ground throughout the day. Ask your child why they think shadows on the ground might change in size, shape, or direction.
• Designate a safe and clean area outside for the activity. Have your child stand still while you draw a box around their shoes on the ground.
• Explain that for each observation, the shadow maker will stand inside the box so they can be traced at the same location. Instruct your child to stand in a comfortable position that they will remember in later observations. Then have the shadow tracer use chalk to trace their partner’s shadow.
• Repeat the tracing at 3 different times during the day. Label each tracing with a time, such as: 12:00 or noon.
• Discussion during and after each observation, with questions such as:
  How do you know where the Sun is in the sky when you look at the direction of your shadow?
  Do you think the shadow will be in a different place at noon? Why do you think that is?
  At what time of day was your shadow the shortest? Longest? Why do you think that is?
Creating Op Art - art that uses optical illusions in the style of Robin Hammer, a West Virginian Artist
Art K-5

Note This lesson can be as simple or as involved as you would like to make it. Students can learn about Robin Hammer, the artist and explore art vocabulary terms. Or you can direct them to create their own op-art masterpieces.

Materials Needed
- Computer, projector and internet to access video
- 8 ½ x 11 white paper for each student
- Pencils, colored pencils, fine point black marker
- copy of vocabulary and definitions (see attached)
- copy of Op-Art examples (see attached)
- copy of color wheel, for reference (see attached)

Activity
Part 1
1. Learning basic art vocabulary and the work of Robin Hammer’s Art
2. Go over the vocabulary terms and definitions. When discussing 2-D and 3-D use examples in the room to illustrate the difference between each term. They are to look for examples of these terms as they watch the following video.
3. View the video, The Artistry of Robin Hammer https://wv.pbslearningmedia.org/resource/99b1fb2a-84a4-4a09-8e8e-025fbb0becd0/the- artistry-of-robin-hammer/ 3:02
4. Return to the vocabulary list and see if students can give examples from the video.

Part 2 -Creating their own Op-Art
1. Show students Op-Art Example A and tell them that they will be creating their own designs using this as a model.
2. Show the video Op Art Like Robin Hammer https://wv.pbslearningmedia.org/resource/0efbc7dc-bcbc-4c86-a64f-e4509de8bcfa/op- art-like-robin-hammer/ 4:12
3. Distribute pencils and paper to each student. Review the directions from the video with students and/or guide them through each step.
4. Start by drawing a horizontal line across the middle of the paper. The line should be slightly wavy. More like rolling hills and less like a roller coaster.

5. Make 8 points on the line like beads on a string, including 2 points near the edges of the paper. The points should be spaced randomly along the line – some closer and some further apart.

6. Connect the dots by drawing “bumps” from dot to dot, connecting the dots near the edges of the paper with imaginary dots off the paper.

7. Make more bumps on top of bumps.

8. Keep making bumps on top of bumps until you reach the edge of the paper. Keep going until you fill in all the space on the paper.

9. Repeat on the other half of the paper (bottom half).

10. Shade each bump from dark at the edges to light in the middle, leaving just a little bit of white in the middle of each bump as a highlight. Use as many colors as you like.

11. When finished, re-draw the lines with a fine-tip marker, or leave it the way it is.

Part 3 – Vocabulary Review

Return to the list of vocabulary words and ask students to point to examples of each in their artwork.

Take Home Challenge

Show students Op-Art examples B and C.
Give each student a piece of white paper and have them lightly trace their hand or draw a big heart outline. Tell them to use the skills they developed earlier to turn their hand/heart into an op-art 3-D picture. They can take it home to finish and share their new vocabulary words with family.
Use colors that are opposite on the color wheel to provide the most contrast. Colors next to each other compliment and blend well with each other.
Students practice making tessellations (an arrangement of shapes closely fitted together, especially of polygons in a repeated pattern without gaps or overlapping from regular and irregular objects as well as become acquainted with the concept of congruence.

Note While 4 video clips are used, each one is only about 2 minutes long. This activity is well suited for a wide age range, the activities provided are differentiated for ages groups.

**Materials Needed**
- Computer, projector and internet to access video
- 8 ½ x 11 white paper for each student
- Colored paper, does not have to be complete sheets
- Pencils, colored pencils, scissors, glue

**Activity**

**Part I- Introduce Tessellations**

1. Follow the Cyberchase gang as they explore tessellations.  
   https://wv.pbslearningmedia.org/resource/vtl07.math.geometry.pla.squares/squares/
2. In these clips the gang looks at other shapes to tesselate. (triangles)Let’s Tesselate ‘Em  
   https://wv.pbslearningmedia.org/resource/vtl07.math.geometry.pla.triangles/triangles/

Have a discussion about tessellations, can all shapes be tesselated? Show them some pictures of famous artworks that are tessellations. (see attached)
Note- if you are working with younger students you do not have to introduce Irregular tessellations.

5. Another type of tessellation is an Irregular Tessellation. Show this clip to explore tessellations with more complex shapes.

6. Play the Wallpaper Tessellations Cyberchase

Discuss how this tessellation is different from regular tessellations. Explain that participants will now make their own tessellations.

**Activity**

**Part 2-Making Tessellations**

**Easy Project:** No cutting is involved for this starter tessellation design, making it a great starting project for younger artists.

- Start with a piece of paper and a pencil. We recommend starting with half of a regular 8.5" x 11" white sheet of paper.
- Divide the paper up into equal width rows (or columns); about 3-4 rows for a small sheet will work very well.
- In one row, draw a simple shape that spans the entire height of the row (see image above), such as a square, triangle, a lopsided rectangle (parallelogram), or other shape of your choice. Draw that shape again immediately next to your first shape. Do they fit together perfectly? What if you draw a third shape immediately next to the second shape? Do they still fit together perfectly?
- If your shapes are fitting together perfectly, keep drawing them in each row until your entire sheet is filled up.
- Color in your tessellation and display!
Step it up: Ready for a harder challenge? Follow the directions on Irregular Tessellations Handout. Try creating more complex shapes, like fish, flowers, or even dinosaurs!

- Challenge: Create a tessellation that repeats at least 12 times. Experiment using different colored paper to see how that effects designs
- Taking it further: [https://www.mathsisfun.com/geometry/tessellation.html](https://www.mathsisfun.com/geometry/tessellation.html)

Making Irregular Tessellations

If we take a shape and lay it down without any gaps or overlaps, that shape tessellates. For example, a square tessellates:

![Figure 1](image1)

Notice the squares can be arranged with others so there are no gaps or overlaps in the surface we make with the squares.

With a shape like a square, we can make some very interesting tessellations. These are called irregular tessellations. Start with a square but turn it into an interesting shape before tessellating it. Start with a square and mark out a shape that can be cut out of one side of the square like this: Figure 1.

We then cut out that shape and paste it on another side of the square like this: Figure 2.

![Figure 2](image2)
Samples of Tessellations