

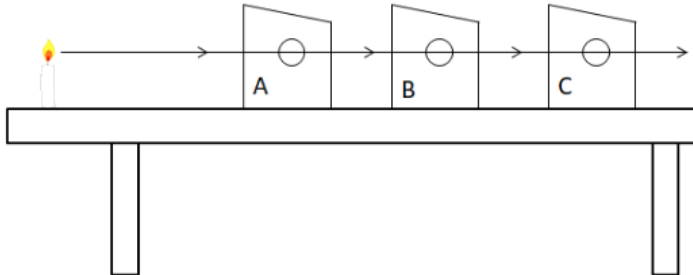
SHADOW PLAY (LEVEL 3)

Description	Learners will set up their own shadow puppet show! They will use concepts such as rectilinear propagation of light, conditions necessary for shadows to form, and factors affecting the size and sharpness of shadows to do so.
Leading question	Can we use shadows to tell a story?
Subjects covered	Science, English, Art and Design
Total time required	40-60 min a day for 5 days
Resources required	Cardboard, old bedsheets, a flashlight, safety pins, scissors, tape, pencils, colours, plastic bags, butter paper, toothpicks/ sticks, a glass tumbler
Learning outcomes:	<p>By the end of this project, learners will be able to:</p> <p>Knowledge-Based Outcomes:</p> <ol style="list-style-type: none"> 1. Explain the role of light and making objects visible to us. 2. Recognize that light propagates rectilinearly. 3. Identify the conditions necessary for shadows to form. 4. Classify objects as transparent, translucent and opaque. <p>21st Century Skill Outcomes:</p> <ol style="list-style-type: none"> 1. Be creative in making shadow puppets and shapes using your hands to design characters for the shadow play. 2. Work collaboratively with friends and family to identify a folk tale to plan the shadow play on, and refine it. 3. Think critically while making inferences from observations during experiments, such as while identifying the rectilinear propagation of light. 4. Communicate the story being told through the shadow play effectively.
Previous Learning	None
Supervision required	Medium

Day 1 -

Today, you will find out how light travels and learn about some properties of shadows.

Time	Activity and Description
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10 minutes	<p>Introduction Let us start this project with an activity!</p> <p>Note: To facilitate the activity:</p> <ul style="list-style-type: none"> - Identify two rooms/ areas in one room that learners will access. - First, ask learners to access one area/ room and make a list of all the objects that they can identify there. - Then, blindfold the learners and ask them to access the other area/ room and make a list of all the objects that they can identify there. <p>When was it easier to identify objects - with the blindfold or without the blindfold? Why?</p> <p>This activity shows us that it is the light that travels to our eyes after being reflected from objects that makes it possible for us to see them.</p>										
20 minutes	<p>Rectilinear Propagation of Light Now that we know that light “travels” to reach our eyes, let us find out what kind of path light takes when it travels.</p> <p>Note: Ask learners to draw the table given below and write their hypothesis in it (light travels in a straight line/ on a curved path/ in a zigzag manner).</p> <table border="1" data-bbox="386 961 1458 1293"> <tr> <td>Hypothesis</td> <td></td> </tr> <tr> <td>Materials Needed</td> <td></td> </tr> <tr> <td>Method</td> <td></td> </tr> <tr> <td>Observations</td> <td></td> </tr> <tr> <td>Inferences</td> <td></td> </tr> </table> <p>Once done, demonstrate the experiment to the learners as described below. They can fill in the rest of the details in the table as the experiment is conducted.</p> <ol style="list-style-type: none"> 1. Cut three cardboard sheets (A, B, and C) and create holes in each. 2. Arrange the sheets in a straight line on a table. 3. Light a candle and position it near sheet A. 4. Peer through the hole in sheet C to observe the candle flame. 	Hypothesis		Materials Needed		Method		Observations		Inferences	
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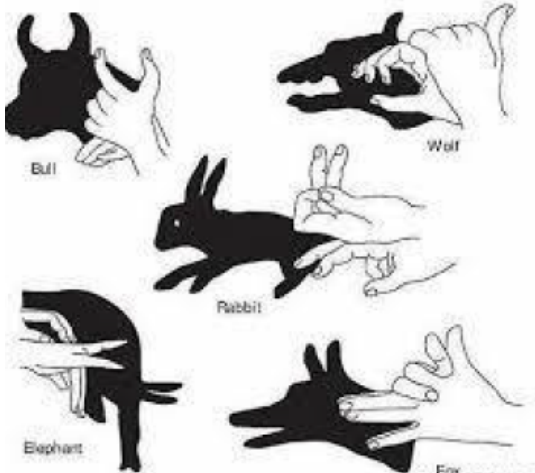
	<p>5. Shift sheet B sideways and attempt to view the flame through sheet C.</p> <p>6. Similarly, shift sheet A sideways and try to view the flame through sheet C again.</p> <p>What did you observe and infer during this experiment?</p> <ul style="list-style-type: none"> - Could you see the flame when the three sheets were arranged in a straight line? - Could you see it when they were not? - What does this tell you? <p>When the sheets were in a straight line, we could see the candle flame through the holes because light moves straight. Moving cardboard left or right disrupted this alignment, preventing the light from passing through the holes.</p>
10 minutes	<p>Introduction to Shadows</p> <p>Note: <i>If it is sunny outside, take the learners outdoors for this activity. If not, use a flashlight as the “sun” and keep its position fixed during the activity.</i></p> <p>Have you ever seen a shadow?</p> <ul style="list-style-type: none"> - Can you think of some objects that make a shadow? - Can you think of an object that does not make a shadow? <p>When light falls on objects, most of them form shadows. Let us do an activity to understand shadows a little better!</p> <ol style="list-style-type: none"> 1. Go outdoors and spot your shadow! 2. Move around and see how your shadow moves. 3. Bring your palm closer to/ further from the surface on which its shadow falls. <p>Let us think about what we noticed:</p> <ul style="list-style-type: none"> - How did your shadow move as you moved? - What happened to the shadow of your palm when you moved it closer to or away from the surface on which it fell? <p>Let us understand how shadows work!</p> <ul style="list-style-type: none"> - Three things are needed for a shadow to be formed: an object, a source of light, and a screen. - In our case, we were the objects, the sun was the source of light, and the ground/ wall was the screen on which the shadow fell. - Shadows always fall in the direction opposite to the source of light with respect to the object. - If the source of light is on the left of the object, the shadow will fall to the right. - Shadows become sharper and smaller when the object is brought closer to the screen, and they become larger and fainter when it is moved away from the screen. - Shadows are never colourful!

At-home activities	<ul style="list-style-type: none"> - Make note of how the shadow changes at different times of the day. To do this, stand outdoors at a fixed position multiple times during the day and draw the shadow that your body forms. - Think about or ask an elder to tell you a folk tale that you would like to perform through your shadow pay.
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Day 2

Today, you will find out how different objects cast different shadows and make some shadows with your hands!

Time	Activity and Description						
20 minutes	<p>Transparent, Translucent and Opaque</p> <p>In the activity we did yesterday, we studied our own shadows! Today, let us do an activity to find out how different objects form shadows differently, and why that happens.</p> <p>Note: To facilitate this activity:</p> <ul style="list-style-type: none"> - Distribute some transparent (such as a clear glass tumbler), some translucent (such as a coloured polythene bag) and some opaque (such as a piece of cardboard) items to the learners. - Ask them to draw the table below, in which they will write their observations. <table border="1" style="margin: 10px auto; width: 60%;"> <thead> <tr> <th style="width: 33%; text-align: center;">Completely allows light to pass through</th> <th style="width: 33%; text-align: center;">Partially allows light to pass through</th> <th style="width: 33%; text-align: center;">Does not allow light to pass through</th> </tr> </thead> <tbody> <tr> <td style="height: 30px;"></td> <td></td> <td></td> </tr> </tbody> </table> <ul style="list-style-type: none"> - Ask them to keep a screen (such as a piece of cardboard or a sheet of paper) ready and inform them that they will try to form shadows of objects on this screen. - Once done, for each object, ask them to aim the flashlight in such a way that the light entirely falls on the object. - Based on how much light passes through, ask them to fill in their observations. <p>Let us think about what we noticed:</p> <ul style="list-style-type: none"> - Which objects mostly allowed light to pass through? What did their shadows look like? - Which objects partially allowed light to pass through? What did their shadows look like? - Which objects completely blocked light? What did their shadows look like? <p>Based on their ability to pass light, objects can be classified into three groups:</p> <ul style="list-style-type: none"> - Transparent objects: These objects allow most of the light falling on them to pass through and form very light or faint shadows. 	Completely allows light to pass through	Partially allows light to pass through	Does not allow light to pass through			
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	<ul style="list-style-type: none"> - Translucent objects: These objects allow some light falling on them to pass through and form darker shadows than transparent objects. - Opaque objects: These objects block most of the light falling on them and form dark shadows. <p>Can you give some more examples of transparent, translucent and opaque objects?</p>
15 minutes	<p>Making Shadows</p> <p>What kind of objects are your hands - transparent, translucent or opaque? How will you find out?</p> <p>Let us make some shadows with our hands to find out whether they are transparent, translucent or opaque!</p> <p>Note: Ask students to use a flashlight as a source of light, a wall/ sheet of paper as the screen, and their hands and fingers as objects to make shadows of different kinds.</p> <ul style="list-style-type: none"> - Encourage them to think about the different characters in their story and ask them to explore making shadows that look like them! - Encourage them to make shadows showing different animals and ask them to think about ways to include some of them in their stories (give them some ideas using the provided image)!  <p>Our hands are opaque because they form dark and sharp shadows, especially when brought close to the screen!</p>
5 minutes	<p>Closure</p> <p>Think and answer:</p> <ol style="list-style-type: none"> 1. What did you learn today that you did not know before? 2. What more do you want to learn about this topic? 3. How will you use what you learned today in your shadow play?
At-home activities	Think about the characters in your story, and how you will perform it through shadow play.

Day 3 –

Today, you will plan your shadow play!

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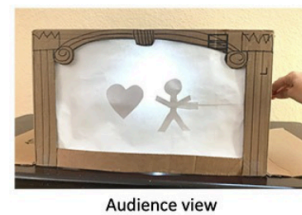
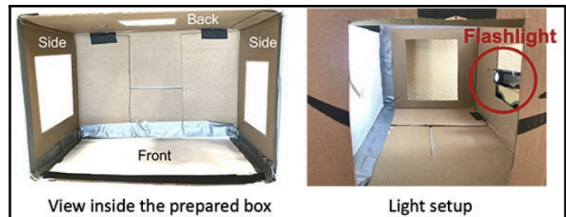
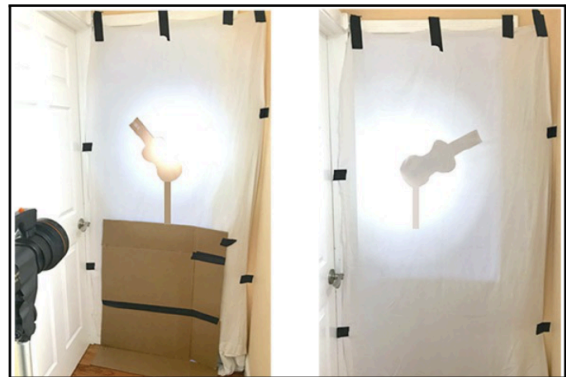
20 minutes	<p>Planning the Story</p> <p>Did you list all the characters in your story? How did you use shadows in your story?</p> <p>Today, we will plan our stories and design characters to use in the shadow play!</p> <p>Note: Inform learners of the following guidelines:</p> <ul style="list-style-type: none"> - Their play should not be more than 10 minutes long (please increase or decrease the time band, if needed) - The story should have at least 3 characters. - They need to first write the story with a clear beginning, middle and end. - Once done, they need to write the story in the form of dialogues and scenes. For example: <ul style="list-style-type: none"> - Scene 1: Characters 1, 2 and 3 are standing around a table. <ul style="list-style-type: none"> - Character 1: Have you seen my chair? - Character 2: It's in the bedroom. - Character 3: He's right, I saw it in the bedroom as well. - At least one character should increase or decrease in size during the play, in the form of a shadow. - At least one character should disappear/ reappear during the play, in the form of a shadow.
20 minutes	<p>Making Shadow Puppets</p> <p>Now you will design characters for your shadow play in the form of puppets! To do this:</p> <ul style="list-style-type: none"> - First, draw the characters of your story. Your characters can be persons, animals, or even imaginary creatures! - Now, plan how you want your puppet to appear on the shadow screen. <ul style="list-style-type: none"> - More than what they look like, it is important what their shadows will look like because your audience will only see their shadows! - Do you need to colour or paint your puppets? (<i>No, shadows are not colourful</i>) - Finally, based on this, draw the puppets of your characters, cut them out, and stick them on toothpicks or sticks.
At-home activities	<ul style="list-style-type: none"> - Finish making any remaining puppets. - Try acting out a scene from the play using the puppets.

Day 4 –

Today, you will set up your performance area, test your puppets, and carry out a rehearsal.

Time	Activity and Description
15 minutes	Setting up the Performance Area

	<p>Let us start with setting up the performance area! If this is a shadow play in which flashlights will act as sources of light and your shadow puppets as objects, what will be the screen? (<i>the wall/ bedsheets/ paper etc</i>)</p> <p>We will make a screen close to one of the walls which is where you will show your performance!</p> <p>Note: <i>Instruct learners to make screens following the instructions given in either of the two options below, based on convenience:</i></p> <p><u>Option 1</u></p> <ul style="list-style-type: none"> - <i>Hang a light-coloured bedsheet or a large sheet of paper from the ceiling to create your screen. Ensure it's flat and leaves space behind for puppet operation.</i> - <i>Make sure there's audience space in front of the screen.</i> - <i>Illuminate most or all of the backside of the screen using a few flashlights.</i> <p><u>Option 2</u></p> <ul style="list-style-type: none"> - <i>Use a large cardboard box to craft your shadow screen.</i> - <i>Place the box with its larger side facing the audience.</i> - <i>Cut out a large rectangle at the front of the box for the puppeteers' hands.</i> - <i>Create rectangles on the adjacent faces for hand insertion.</i> - <i>Cut a rectangle on the back of the box for flashlight entry, illuminating the screen.</i> - <i>Cover the front cutout with white paper to complete the screen.</i>
10 minutes	<p>Testing the Puppets</p> <p>Now, we will test our shadow puppets on the screen that we will use during our performance!</p> <p>Note: <i>Allow learners to test their puppets on the screen. Encourage them to make any changes that they may need to based on the shape/ form of the shadows.</i></p>
15 minutes	<p>Rehearsal</p> <p>Finally, let us rehearse our play!</p>



	<p>Note:</p> <ul style="list-style-type: none"> - Allow learners to rehearse the play following the scenes and dialogues that they had written, based on the folk tale they chose. - If only one learner is participating in the module, and you see a need for more than one person to operate the puppets and narrate the story, ask learners to bring a friend to the class for this activity beforehand. <p>Tip: Help learners refine their performance by providing inputs such as:</p> <ul style="list-style-type: none"> - They can try and modulate their voice to sound different for each character. - They can try and bring in emotions in their dialogues by sounding excited, upset, happy, disappointed etc.
At-home activities	Invite your friends and family to watch your performance in the next class!

Day 5 -

Today, you will perform your shadow plays and reflect on this project.

Time	Activity and Description
15 minutes	<p>Note: Ask learners to bring their friends and family to the class to watch the shadow play they have designed.</p> <p>Preparation Let us prepare for our shadow plays!</p> <ul style="list-style-type: none"> - Check the screen. - Ready the sources of light (<i>this can be a strong light or a combination of flashlights</i>) - Check if we have all our shadow puppets and the script ready for reference if needed!
20 minutes	<p>Performance Let us start with our shadow play!</p> <p>Note: As learners perform their shadow play, ask the audience to think about:</p> <ul style="list-style-type: none"> - What they liked about the story - What they liked or noticed about the use of light and shadows - What they think could have been done better <p>Once the play has been performed, ask the audience to share their feedback along the above lines with the learners.</p>
5 minutes	<p>Reflection Congratulations on putting together such an innovative play! Let us reflect on the following questions:</p> <ul style="list-style-type: none"> - What did I enjoy during this project? - What was difficult? How did I overcome the difficulty? - What did I learn that I did not know earlier? - What more do I want to learn about light and shadows?

Additional enrichment activities:	<ul style="list-style-type: none"> - Learners can write and direct their own plays, based on stories that they have written. - Learners can be asked to write a report on the use of scientific concepts in making their performance happen.
Modifications for simplification	Learners can be asked to perform easier stories.

ASSESSMENT CRITERIA

A majority of my students were able to:

- Explain the role of light and making objects visible to us.
- Recognize that light propagates rectilinearly.
- Identify the conditions necessary for shadows to form.
- Classify objects as transparent, translucent and opaque.
- Perform a shadow play applying concepts related to light and shadows.