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Classroom Embedded Assessment [CEA] Title: Seeing the New Bedroom

a. Targeted Performance Expectation(s)

1-PS4-3 Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light. [Clarification Statement: Examples of materials could include those that are transparent (such as clear plastic), translucent (such as wax paper), opaque (such as cardboard), and reflective (aluminum foil).] [Assessment Boundary: Assessment does not include the speed of light.]

Supplemental Information about Targeted Performance Expectation

DCI Progression of learning:

Objects can only be seen when light illuminates them. * (1-PS4-2 may have been explored previously.)

Objects appear to look different with different amounts of light. * The perceived color (or brightness of color) of an object is different with varying amounts of light.

Very hot objects give off light. (fire, sun, light bulb filament, etc.)

Light travels from place to place.* (This can be evidenced by looking at where the light source is and where the light may appear as it strikes another surface or particles in the air.)

Light reacts in different ways when it strikes different types of materials.*

- Light may pass through them.
- Part of the light may pass through them.
- Other materials block most light and create a dark shadow beyond them.

Mirrors or prisms may change the direction of a beam of light.

Prior instructional experiences:

Students will collaboratively design an investigation to answer the question, “What happens when light strikes different objects?”

Students will identify the phenomenon (light’s reaction to different materials that allow light to pass through them in different ways).

Students will plan an investigation to test this reaction with a variety of materials.

(Exploration first, design investigation after ideas start to form. Editorial note.)

Observations should include transparent, translucent, opaque, and reflecting objects.

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Students should describe observations (with support) in oral or written form, possibly including drawings or models from testing these materials, and how this is evidence to help answer their question. They may classify objects by their interaction with light.

Constructing Explanations and Designing Solutions –

Students will use information from observations to construct an evidence-based account for natural phenomena.

Cause and Effect –

Simple tests can be designed to gather evidence to support or refute student ideas about causes.

Students will observe the effects of light shining through different objects and record this data in investigations. Then they will apply this knowledge to the new scenario in the task.

Misconceptions

Students may believe that their eyes can always adjust to conditions and see an object eventually, even in the dark, not recognizing that some amount of light is required to see an object.

Another common misconception is that light can only be reflected from shiny surfaces (such as a mirror). Students may also believe that an object cannot absorb and reflect light – it must do one or the other. Of course, the correct concept is that all objects absorb and reflect light to different degrees. Our ability to see objects depends on the reflection of light!

b. Learning Goal(s)

Students will be able to:

1. describe how differences in things they see are a result of cause/effect interactions with light and different materials from their observations.

After investigating the interactions of light and various materials, students will be able to:

2. provide evidence from these investigations to support a claim about why the amount of light shining through an object affects the way the object appears.

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c. Instructional Context

This CEA might be used in the middle of the unit after the following experiences:

- Students have previously figured out that light is needed to see objects clearly, and to distinguish between colors, from previous experiences. This may have been done using “dark boxes” or making observations in a room without light, and in a room where light is added in increments. Data from these observations has been used to make evidence-based accounts (claims).
- Students have experimented and explored with making observations to answer the question, “How does light interact with different materials?” This might have been using sunlight or a flash light as the light source. Students would collect data about different types of interactions (little shadow, a faint shadow, a dark shadow, a reflection or direction of the light beam.)
- Students have collaborated with the teacher to design an investigation to test various materials (after initial exploration.) They would control the way they placed the materials in the beam of light, and recorded data about their observations. They have test materials that let most all of the light shine through (like clear plastic or clear glass), some of the light shine through (like clouded plastic or wax paper), and materials that block most all of the light (like wood or cardboard). They would also have experimented with materials that change the direction of light like a mirror or a prism. Students might group materials tested by the interactions they observe, and look for common properties.

Students might be shown a material, and asked to predict how it would interact with light, based on data collected earlier. (If a mirror is shiny and you can’t see through it, and then you look at a shiny, opaque piece of foil, what might you predict would happen?)

d. Student Task/Prompt – *see end of document for copy of handouts distributed to students*

Scenario/Phenomenon:

Big Surprise!

One day, Matt and Joy ran in the back door from school. Their mom said, “I have a surprise for the both of you! Run to your rooms and check it out!”

They both ran up to their bedrooms. Mom had changed their rooms by putting up new curtains, new rugs, and bedspreads. When they reached Joy’s room they saw bright yellow curtains, a purple rug, and a yellow, green, and purple flowered bedspread. Matt was shocked to walk into his dark room. He could not see the color of his new bedspread or rug!

Multiple Component Questions:

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1. Why was Matt’s bedroom so dark? Give evidence from your investigations with light and objects to support your answer. (This could be oral, written, or using drawings.)
 2. Why do you think Joy could see more colors in her bedroom?
 3. How much light do you think was coming through Joy’s window? Give evidence from your investigations with light and objects to support your answer. (This could be oral, written, or using drawings.)
- (Student Task Sheet at end)**

e. Success Criteria

Exemplary student response

1. Matt’s bedroom was dark because the curtains in his window were not letting much light through. An object that doesn’t let much light through and blocks a lot of light makes a dark shadow on the other side.
In our investigation, we saw that cardboard blocked a lot of light, and there was a dark shadow on the other side. Matt’s bedroom curtains must have blocked light so that you couldn’t see much in his room.
2. Joy could see more colors in her bedroom because more light was coming through the curtains. You can see more colors when the light is brighter.
3. I think a lot of light must be coming through Joy’s window and curtains since she could see the colors of the bedspread and her rugs.
In our investigation, we saw that lots of light went through the clear plastic sheet. We could see the colors of the objects through the clear plastic.

Note: Students may be able to use vocabulary such as transparent, translucent, opaque, or reflect, if it has been introduced in the context of describing the interactions observed. However, the important thing to assess here is if they can describe the interactions that occur when light shines on objects. Use of that vocabulary is not required to show conceptual understanding.

Rubric A for Student Responses

4	Response shows evidence that <ul style="list-style-type: none">• student can see cause/effect relationships between the properties of the curtain fabric and the amount of light in the room
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	<ul style="list-style-type: none"> • student can give examples of materials they investigated that had similar interactions with light to the different curtain fabrics
3	Response shows evidence that <ul style="list-style-type: none"> • student can see cause/effect relationships between the properties of the curtain fabric and the amount of light in the room • student can give an example of a material they investigated that had similar interactions with light to one of the different curtain fabrics
2	Responses show evidence that <ul style="list-style-type: none"> • student may see some cause/effect relationships between the properties of the curtain fabric and the amount of light in the room, but their description is not clear • student can give an example of a material they investigated that had similar interactions with light to one of the different curtain fabrics but their description may not be clear
1	Responses show evidence that <ul style="list-style-type: none"> • student may see some cause/effect relationships between the properties of the curtain fabric and the amount of light in the room, but their description is not clear • student is not yet able to give examples of materials they investigated that had similar interactions with light to one of the different curtain fabrics
0	Responses show evidence that <ul style="list-style-type: none"> • student is not yet able to see cause/effect relationships between the curtains and the visibility in the room • student is not yet able to provide examples of materials they investigated that had similar interactions with light
Or	

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Rubric B for Student Responses

<p>Question 1</p>	<p>Does student show evidence of understanding the cause/effect relationship between the curtain fabric and the room being dark? 1 – Yes 0 – No</p> <p>Can the student provide an example from their investigations of a material that blocked a lot of light, like Matt’s curtains? 1 – Yes 0 – No</p>
<p>Question 2</p>	<p>Does student show evidence of understanding the cause/effect relationship between the curtain fabric and being able to see colors and objects in Joy’s room? 1 – Yes 0 – No</p>
<p>Question 3</p>	<p>Does the student show evidence of understanding that a lot of light must be coming through the window to see colors of the objects? 1 – Yes 0 – No</p> <p>Can the student provide an example from their investigations of a material that let a lot of light through, like Joy’s curtains? 1 – Yes 0 – No</p>

f. Next Instructional Steps

If students are having difficulty understanding the **cause/effect relationship** of the material and the observed light interaction provide additional experiences and scaffold the observations with sentence frames such as –

If there is a dark shadow behind a material, then _____.
 (a lot of light is blocked)

If there is not much of a shadow behind a material, then _____;
 (a lot of light went through it)

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With a lot of light, you can see _____.
(things more clearly, things in color)

When there is not much light going through a material, then _____.
(it is hard to see things clearly or see colors)

Note that the student misconceptions previously listed would be addressed in these continuing investigations.

If students are having difficulty **applying the observations from their investigations**, investigate additional materials and look at the amount of resulting light passing through.

Ask students to collect data (possibly on a group chart). Then shine light through a material where the material is not visible to students, but the resulting shadow or light pool is visible. Using the information from our chart of observations, what kind of material might be making that result?

Possible extensions –

- Is the amount of light that shines through an object something we can measure? Use a light meter app (like “myLightMeter”) to record numeric measurements of the amount of light coming through a material. Looking at the numeric measurements, compare those to the visible results recorded (in drawings or words) from earlier tests.
- Engineering extension – How does the way an object interacts with light affect the way it is used? What materials would make a good window? What materials would be best to have for a roof or walls to block light? Students could construct a small model of a house using a variety of materials that interact differently with light. They can present their design, and use the data collected in earlier tests to explain why they chose the materials they did for the parts of the house.

g. Student Work Samples

Not available.

h. Reflection and Revision

Not available.

NOTE: Student handout begins on next page

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Big Surprise!

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They both ran up to their bedrooms. Mom had changed their rooms by putting up new curtains, new rugs, and bedspreads.

When they reached Joy’s room they saw bright yellow curtains, a purple rug, and a yellow, green, and purple flowered bedspread.



Joy’s Bedroom



Matt’s Bedroom

Matt was shocked to walk into his dark room. He could not see the color of his new bedspread or rug!

1. Why was Matt’s bedroom so dark? Give evidence from your investigations with light and objects to support your answer.

2. Why do you think Joy could see more colors in her bedroom?

3. How much light do you think was coming through Joy’s window? Give evidence from your investigations with light and objects to support your answer.
