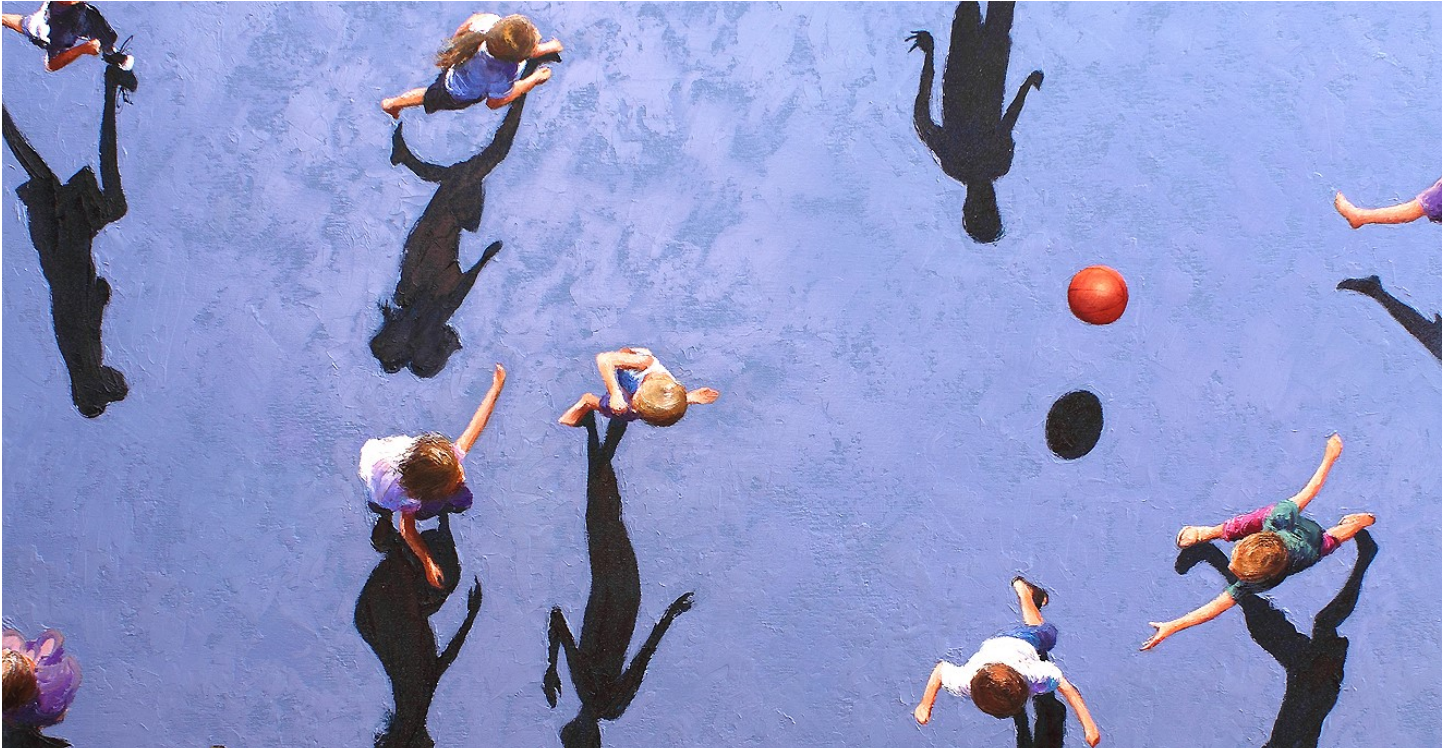


Cause and Effect



Unit Essential Questions

- What are sources of light in our environment?
- How can we use light to create shadows?
- How can we measure shadows from the light source to the end of the shadow?

UNIT DESCRIPTION

In this unit, students will use the arts to experience the mysterious science behind lights and shadows! By integrating the visual arts, the students will work in teams of three to create a painted triptych showing the relationship between light and an object's shadow in the morning, noon, and afternoon. Using music, students will demonstrate durations of light using instruments. Students will get on their feet and dance in order to create and perform shadow dances with movement.

PROJECTS

- Dancing Shadows
- Waves: Lights and Sounds
- Sounds of Shadows

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Units provide differentiated ideas and activities aligned to a sampling of standards. The units do not necessarily imply mastery of standards, but are intended to inspire and equip educators.

Produced through the U.S. Department of Education: Arts in Education—Model Development and Dissemination Grants Program
Cherokee County (GA) School District and ArtsNow, Inc.

Unit Description	Table of Contents
<p>In this unit, students will use the arts to experience the mysterious science behind lights and shadows! By integrating the visual arts, the students will work in teams of three to create a painted triptych showing the relationship between light and an object's shadow in the morning, noon, and afternoon. Using music, students will demonstrate durations of light using instruments. Students will get on their feet and dance in order to create and perform shadow dances with movement.</p>	<p>Dancing Shadows Waves: Lights and Sounds Sounds of Shadows</p>

UNIT ESSENTIAL QUESTION

- What are sources of light in our environment?
- How can we use light to create shadows?
- How can we measure shadows from the light source to the end of the shadow?

CROSS-CUTTING INTERDISCIPLINARY CONCEPT

Cause and Effect

REAL WORLD CONTEXT

- Students will watch video “How do solar panels work?”
- Teacher will discuss video in relation to the real world.
- Teacher will ask “What is solar energy?” “Where would you find solar panels?” “Why are they important?”
- The students will build solar ovens. (Please preview links beforehand):
 - <http://reachoutmichigan.org/funexperiments/agesubject/lessons/smores.htmlview>
 - <http://alittlecampy.com/diy-solar-oven-smores/>
- After the ovens are built, place in the sunlight to “cook.” While students enjoy the s’mores, ask the questions: “How did you use the sun to make an oven?” “How does your oven compare to the solar panel?”

STANDARDS

Curriculum Standards	Arts Standards
<p>S1P1 Students will investigate light and shadows. a. Recognize sources of light. b. Explain how shadows are formed.</p> <p>ELAGSE1W2 Write informative/explanatory texts in which they name a topic, supply some facts, and provide a sense of closure.</p>	<p>D1CO.4 Demonstrates an understanding of dance as it relates to other areas of knowledge. b. Explores commonalities of essential concepts shared between dance and other subject areas.</p> <p>TAES1.5 Directing by conceptualizing, organizing and conducting rehearsals for performance.</p> <p>M1GM.4 Improvising melodies, variations, and accompaniments. a. Improvise simple body percussion patterns. b. Improvise soundscapes (e.g., weather, animals, and other sound effects).</p>

	VA1MC.3 Selects and uses subject matter, symbols, and ideas to communicate meaning.
--	--

ASSESSMENTS**Summative Assessments**

- Pre/Post-Test

CHARACTER EDUCATION COMPONENTS

- Partner with another class to participate in a gallery walk of the shadow paintings.
- Partner with another class to participate in viewing of the shadow dances.

CHARACTER ATTRIBUTES

- Self-Discipline
- Teamwork

PARTNERING WITH FINE ARTS TEACHERS**Music Teacher:**

- Assist with the music vocabulary instruction, specifically in “Waves: Lights and Sounds” project.

Visual Arts Teacher:

- Assist with the visual arts vocabulary instruction, specifically “Dancing Shadows” project.

APPENDIX (See Downloads)

- Pre/Post-Test

ADDITIONAL RESOURCES**Books:**

- *Shadow (A Wordless Picture Book)* by Suzy Lee

Possible Field Trips:

- Imagine It! Children’s Museum
- Shenandoah Valley Children’s Museum (branch located at KSU and Newnan)
- Fernbank Science Center

WEBSITES:

- YouTube Video: [How do solar panels work? - Richard Komp – YouTube](#)
- <https://www.quavermusic.com/Default.aspx>
- <https://www.google.com/culturalinstitute/user-gallery-edit/iAISEBIBPT3qIA?projectId=art-project&preview=true&position=0%3A6>
- <http://www.stevespanglerscience.com/lab/experiments/solar-oven/>
- <https://m.youtube.com/watch?v=-hL28SkHf1g>
- https://drive.google.com/folderview?id=0BxpG5nFz0YNHOExpWIFyZVJIRXM&usp=sharing_eid&invite=COFH5aYH&ts=573b6005&usp=sharing_eid&tid=0BxpG5nFz0YNHcVlxZMtZnNuZTQ

CREDITS

U.S. Department of Education
Arts in Education--Model Development and Dissemination Grants Program
Cherokee County (GA) School District and ArtsNow, Inc.
Ideas contributed and edited by:
Catherine Shaw, Tammy Owen, Erica Hagood, Jessica Espinoza

Exploring Our World through Lights and Shadows Pre/Post-Test

Name _____ Date _____

Part A: SELECT A RESPONSE

Directions: Teacher will read aloud the questions and responses below.

1. Circle the pictures that are sources of light:



2. How are shadows made?

- a) By rain collecting mud puddles
- b) By plugging in a blowdryer
- c) By a tree blocking direct sun light
- d) By turning a water faucet on

3. How do shadows change as the light source moves?

- a) The shadow gets shorter or longer based on the light source.
- b) The shadow can disappear when a light source moves.
- c) A shadow can shift in shape when the light source moves.
- d) All of the above

PART B: DRAWING SHADOWS

4. Draw a shadow. Indicate where the light source would be in your drawing.

5. Draw where the light source is located.



PART C: EXTENDED RESPONSE

Describe a time when you noticed a shadow. Where were you? Where was the light source located?



Project Essential Questions

- How can I use movements to create a shadow?
- What would happen if a light source is blocked?
- How can I use dance to explore science through shadows?
- How are shadows made?

PROJECT DESCRIPTION

In this project, students will use dance to perform a role illustrating a shadow. Students will explore how shadows are cast and how they can grow and shrink in size. Dance and light will help bring this concept to life!

LEARNING TARGETS

“I Can...”

- Create a shadow using my body
- Explain how shadows are made
- Use dance to demonstrate how shadows work

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Produced through the U.S. Department of Education: Arts in Education—Model Development and Dissemination Grants Program
Cherokee County (GA) School District and ArtsNow, Inc.

DURATION: 2-3 days

Project Description	Learning Targets
<p>In this project, students will use dance to perform a role illustrating a shadow. Students will explore how shadows are cast and how they can grow and shrink in size. Dance and light will help bring this concept to life!</p>	<p>“I Can...”</p> <ul style="list-style-type: none"> ● Create a shadow using my body ● Explain how shadows are made ● Use dance to demonstrate how shadows work

ESSENTIAL QUESTIONS

<ul style="list-style-type: none"> ● How can I use movements to create a shadow? ● What would happen if a light source is blocked? ● How can I use dance to explore science through shadows? ● How are shadows made?
--

STANDARDS

Curriculum Standards	Arts Standards
<p>S1P1 Students will investigate light and shadows. a. Recognize sources of light. b. Explain how shadows are formed.</p> <p>ELAGSE1W2 Write informative/ explanatory texts in which they name a topic, supply some facts, and provide a sense of closure.</p>	<p>D1CO.4 Demonstrates an understanding of dance as it relates to other areas of knowledge. b. Explores commonalities of essential concepts shared between dance and other subject areas.</p> <p>TAES1.5 Directing by conceptualizing, organizing and conducting rehearsals for performance.</p>

KEY VOCABULARY

Content Vocabulary
<ul style="list-style-type: none"> ● Light ● Shadows ● Light Source
Art Vocabulary
<ul style="list-style-type: none"> ● Level: one of the aspects of the movement element space. In dance there are 3 basic levels: high, middle and low. ● Pathway: the designs traced on the floor as a dancer travels across space; the designs traced in the air as a dancer moves various body parts. ● Shape: refers to an interesting and interrelated arrangement of body parts of one dancer; the visual makeup or molding of the body parts of a single dancer; the overall visible appearance of a group of dancers. ● Symmetrical: a visually balanced body shape or grouping of dancers.

TECHNOLOGY INTEGRATION

<ul style="list-style-type: none"> ● Shadow Dance Link: https://drive.google.com/folderview?id=0BxpG5nFz0YNHOExpWIFyZVJIRXM&usp=sharing_eid&invite=COFh5aYH&ts=573b6005&usp=sharing_eid&tid=0BxpG5nFz0YNHcVlxZMtZnNuZTQ
--

ASSESSMENTS

Formative	Summative
<ul style="list-style-type: none"> Teacher will observe shadow dances for the understanding of shadow formation. 	<ul style="list-style-type: none"> The teacher will assess the performance of the shadow dance and illustrations using the rubric.

MATERIALS

<ul style="list-style-type: none"> White shower curtain or drop cloth Spot light
--

Activating Strategy (5-10 min)

<ul style="list-style-type: none"> Show the video of Shadow Dances: https://drive.google.com/folderview?id=0BxpG5nFz0YNHOExpWIFyZVJIRXM&usp=sharing_eid&invite=COFH5aYH&ts=573b6005&usp=sharing_eid&tid=0BxpG5nFz0YNHcVlxXzMtZnNuZTQ Questions to ask the students: “How are shadows made?” “Where can we see shadows everyday life?” “Can you use your body to create a shadow dance?” “How did the dancers use their body to create shadows?” “What shapes are created with the dancers’ body movements?”
--

Main Activity

PART 1

- Introduce the science and dance vocabulary. Discuss the meaning of the vocabulary words in relation to the video “Shadow Dances.”
- Encourage and assist the students in picking out the key vocabulary in the video. Make a list of the vocabulary terms that are found/recognized in the video.

PART 2

- Review the chart with the dance and science vocabulary.
- Divide the students into pairs.
- Direct students to create a three-part dance illustrating sizes and placement of shadows in different parts of the day (morning, afternoon and night) using only their bodies and no sound with their movements. The movements will be a reflection of movements for that part of the day. “What happens in the morning, afternoon and evening?”
- Students will use the three-part document to illustrate dance movements. After illustrating, depending on their role in the dance, students will write a sentence about their movements and or shadow.

Part 3

- When the students are ready to share their shadow dances, the teacher will ask the following questions:
 - How would your movements change if the light source moved?
 - Did your shadow have the same shape as the original movement?
 - Was the original image and shadow symmetrical?
 - Did your dance include a pathway?

Classroom Tips:

- Discuss self-discipline in relation to working in a group and performing together.*

REFLECTION

Reflection Questions

- How are shadows related to light?
- Can you predict the outcome if there is no light?
- How did you apply what you learned to developing a shadow dance?

DIFFERENTIATION

Accelerated:

- Using the poem “Shadow Race” by Shel Silverstein (*A Light in the Attic*), students will decide which hypothesis would be true:
 1. The shadow will win the race because the sun is behind me.
 2. The sun will win the race because the sun is front of me.
- Have the students go outside and run the race to confirm/reject the hypothesis.
- The students could also predict the outcome if the race were done in a different location or at a different time of day (confirm if possible).

*Every time I've raced my shadow
When the sun was at my back,
It always ran ahead of me,
Always got the best of me.
But every time I've raced my shadow
When my face was toward the sun,
I won.
Shel Silverstein, “Shadow Race”*

Remedial/EL Students:

- Part 2: Allow EL and remedial students who need visuals to have their drawings in front of them as a visual aid to remember their movements. When writing their sentence, the students may use a “sentence frame” to focus learning on specific vocabulary.
 - Ex. My dance movement for (morning/afternoon/night) was _____ because _____.
- Part 3: Ask students 2 questions, using simplified vocabulary, with verbal and visual cues. Allow students who struggle with vocabulary to answer their questions toward the end so they are provided with modeling of correct answers.

APPENDIX

- Dancing Shadows Rubric
- Dancing Shadows Illustration Handout

CREDITS

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Ideas contributed and edited by:
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Dancing Shadows Illustrations




Name _____

In the Morning:

In the Afternoon:

In the Evening:

Dancing Shadows Rubric

CHECKLIST			
My dance had three different parts, one for morning, afternoon and evening. In each part, the correct shadow placement and size was displayed.	All three parts are accurate.	Only two parts are accurate.	One or no parts are accurate.
My dance reflected the appropriate movement/shadow for the time of day, morning, afternoon and evening.	My dance was correct for the time of day.	My dance was somewhat correct for the time of day.	My dance didn't show the correct time of the day.
I wrote using complete sentences to demonstrate how shadows move throughout the day.	All sentences are complete, and they all begin with a capital letter and end with punctuation.	Most sentences are complete, and most begin with a capital letter and end with punctuation.	Few to no sentences are complete, and they do not begin with a capital letter or end with punctuation.
I worked well with my partner. I took turns listening and speaking when brainstorming and creating/rehearsing together.	I listened to my group members, considered all ideas, and took turns speaking all the time.	I listened to my group members, considered all ideas, and took turns speaking some of the time.	I did not listen to my group members, consider their ideas, nor take turns speaking.



Project Essential Questions

- How does the time of day affect the relationship between an object and its shadow?

PROJECT DESCRIPTION

In this project, students will work in small groups to create a painted triptych showing the relationship between an object and its shadow in the morning, noon, and afternoon. Students will then have the opportunity to analyze how and why the shadows changed throughout the course of the day.

LEARNING TARGETS

“I Can...”

- Create a painting using canvas that shows shadows at various times of the day
- Work in a group of three to demonstrate and explain shadow progression throughout the day

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Produced through the U.S. Department of Education: Arts in Education—Model Development and Dissemination Grants Program
Cherokee County (GA) School District and ArtsNow, Inc.

DURATION: 1 week

Project Description	Learning Targets
<p>In this project, students will work in small groups to create a painted triptych showing the relationship between an object and its shadow in the morning, noon, and afternoon. Students will then have the opportunity to analyze how and why the shadows changed throughout the course of the day.</p>	<p>“I Can...”</p> <ul style="list-style-type: none"> • Create a painting using canvas that shows shadows at various times of the day • Work in a group of three to demonstrate and explain shadow progression throughout the day

ESSENTIAL QUESTIONS

- How does the time of day affect the relationship between an object and its shadow?

STANDARDS

Curriculum Standards	Arts Standards
<p>S1P1 Students will investigate light and shadows.</p> <p>a. Recognize sources of light.</p> <p>b. Explain how shadows are formed.</p> <p>1.MD.A.2 Students will measure the length of objects using nonstandard units.</p>	<p>VA1MC.3 Selects and uses subject matter, symbols, and ideas to communicate meaning.</p>

KEY VOCABULARY

Content Vocabulary
<ul style="list-style-type: none"> • Light source (manmade & natural) • Shadows • Measure • Nonstandard unit
Art Vocabulary
<ul style="list-style-type: none"> • Media: the tools and materials an artist uses • Subject matter: the things that are represented in a work of art such as people, buildings, and trees • Emphasis: in a composition, developing points of interest to pull the viewer’s eye to important parts of the body of the work • Triptych: a picture or relief carving on three panels • Sketch: a simple drawing giving the essential features without the details • Still life: a representation of inanimate objects, as a painting of a bowl of fruit • Background: the area of artwork that appears furthest away and is smallest

TECHNOLOGY INTEGRATION

- Gallery walk of Van Gogh’s paintings that use sources of light:
<https://www.google.com/culturalinstitute/user-gallery-edit/what-light-sources-does-van-gogh-use-in-his-paintings/iAISEBIBPT3qIA?projectId=art-project>

ASSESSMENTS

Formative	Summative
<ul style="list-style-type: none"> Observe the accuracy of how groups demonstrate the progression of shadows throughout the day. Questioning 	<ul style="list-style-type: none"> Waves: Lights and Sounds Rubric (See Downloads)

MATERIALS

<ul style="list-style-type: none"> 4x6 canvas (1 per student) Acrylic paint (various colors) Paint brushes Smocks Sidewalk chalk iPad or video camera https://www.google.com/culturalinstitute/user-gallery-edit/what-light-sources-does-van-gogh-use-in-his-paintings/iAISEBIBPT3qIA?projectId=art-project
--

Activating Strategy (5- 10 min)

<ul style="list-style-type: none"> Gallery Walk on Google Cultural Institute (see technology link) Ask students activating questions: <ul style="list-style-type: none"> <i>What do you see in this artwork?</i> <i>What do you see that makes you think that?</i> <i>What more can we find?</i> <i>What do you think the light source is for this artwork?</i> <i>How can you tell? What evidence do you see?</i> <i>Do you see a shadow?</i> <i>Based on the shadow, what time of day do you think it is? (Refer to shadow exploration from outside activity if needed.)</i>
--

Main Activity**PART 1: Shadow Exploration**

<ul style="list-style-type: none"> Tell students that we are going to explore shadows. Ask students what they already know about shadows. Make a chart of their responses. Take students out three different times of day (morning, noon, and afternoon). Students will choose a partner. One will trace the shadow of the other. (Have them write their name on the shadows so they remember which one is theirs.) Take students out at noon and in the afternoon. After each time they will trace the shadow, they will measure the shadow with a nonstandard unit such as student chairs. Students will record the lengths of their shadows at each time of day for comparison (see resources). After all comparisons have been made, in a class discussion, ask students what they now know about shadows. Record student responses with the original responses and discuss findings as a class.
<u>PART 2: Looking at Van Gogh</u> <ul style="list-style-type: none"> Show students gallery from Google Cultural Institute (see link in technology). As you progress through the artwork, focus on the light sources, how the background relates to the time of day, and shadow placement.

- Examine Van Gogh’s style of painting. Zoom in and look at brush strokes and differing colors used in background to give the art some depth.
- Tell students that they will create their own artwork showing the relationship between shadows, objects, and time of day.

PART 3: Painting

- Set up still life by manipulating a light to set to up the time of day.
- Tell students to pay close attention to the size relationship between the still life and the canvas panel.
- Students will then sketch lightly with a pencil to their object and the shadow that it cast, paying close attention between the two.
- Students will then paint their sketch using acrylic paints. (Wear smocks during painting.)
- Tell students the background should correspond to the time of day being represented. Refer back to Van Gogh paintings if needed.

Classroom Tips:

- Review proper handling of paint and painting tools, process of painting, and clean up procedures. Make paint pallet with a disposable plastic/Styrofoam plate. Cover with saran wrap to save for following days.

REFLECTION**Reflection Questions**

- Students will write what they learned about shadows.
- Students will record their thoughts (using an iPad or video camera) on how the project helped them understand how shadows are created and move through space.
- Reflection questions:
 - *Did this project help you understand lights and shadows more than others we have done? Why?*
 - *If you could do this project over, what would you do differently?*
 - *How can you prove to the teacher you know the objective?*

DIFFERENTIATION**Accelerated:**

- Advanced students could create their “shadow pictures” in colors representing the different times of day. For example, the morning shadow might be a cool color because the temperature is cooler in the morning, the afternoon might be a neutral color, and the late afternoon might be a warm color.

Remedial/EL Students:

- Part 2: Preview in small group Van Gogh’s paintings with remedial and EL students before doing whole group lesson. Review content and visual arts vocabulary. Have the students restate vocabulary definitions in their own words.
- Reflection:
 - Use simplified vocabulary, with verbal and visual cues.
 - Allow students to use sentence frames to form their sentence about what they learned.

APPENDIX (See Downloads)

- **Waves: Lights and Sounds Rubric**
- **Shadow Recording Sheet**

CREDITS

U.S. Department of Education

Arts in Education--Model Development and Dissemination Grants Program

Cherokee County (GA) School District and ArtsNow, Inc.

Ideas contributed and edited by:




Catherine Shaw, Tammy Owen, Erica Hagood, Portia Whitlow, Jessica Espinoza

Shadow Recording Sheet

Time of Day	Length of Shadow
Morning	
Noon	
Afternoon	






Waves: Lights and Sounds Rubric

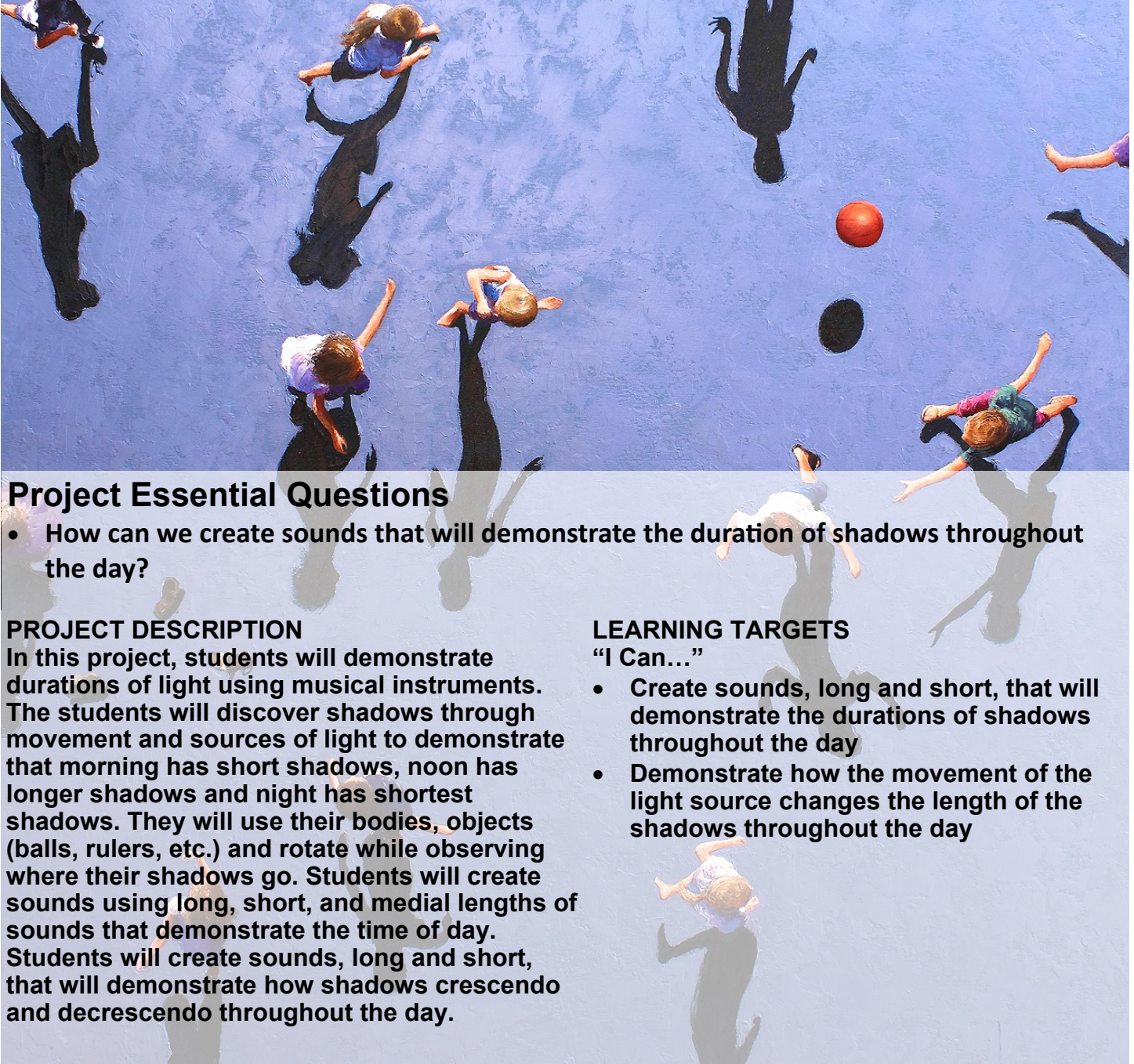
CHECKLIST			
My painting reflects an accurate representation of an object and its shadow to the time of day.	All three representations are accurate.	Only two of the representations are accurate.	One or none of the representations are accurate.
My writing explains why shadows are different lengths at different times of the day.	My writing includes references to both types of changes (length and position).	My writing includes references to only one of the changes.	My writing does not reference either change.
I wrote complete sentences to tell what I learned about light and shadows.	All sentences are complete and begin with a capital letter and end with punctuation.	Most sentences are complete and begin with a capital letter and end with punctuation.	Few to no sentences are complete. Most do not begin with a capital letter or end with punctuation.
I worked well with my group. I took turns listening and speaking when brainstorming and working together.	I listened to my group members, considered all ideas, and took turns speaking all the time.	I listened to my group members, considered all ideas, and took turns speaking some of the time.	I did not listen to my group members, consider their ideas, nor take turns speaking.

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Waves: Lights and Sounds Rubric

CHECKLIST			
My painting reflects an accurate representation of an object and its shadow to the time of day.	All three representations are accurate.	Only two of the representations are accurate.	One or none of the representations are accurate.
My writing explains why shadows are different lengths at different times of the day.	My writing includes references to both types of changes (length and position).	My writing includes references to only one of the changes.	My writing does not reference either change.
I wrote complete sentences to tell what I learned about light and shadows.	All sentences are complete and begin with a capital letter and end with punctuation.	Most sentences are complete and begin with a capital letter and end with punctuation.	Few to no sentences are complete. Most do not begin with a capital letter or end with punctuation.
I worked well with my group. I took turns listening and speaking when brainstorming and working together.	I listened to my group members, considered all ideas, and took turns speaking all the time.	I listened to my group members, considered all ideas, and took turns speaking some of the time.	I did not listen to my group members, consider their ideas, nor take turns speaking.

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Project Essential Questions

- How can we create sounds that will demonstrate the duration of shadows throughout the day?

PROJECT DESCRIPTION

In this project, students will demonstrate durations of light using musical instruments. The students will discover shadows through movement and sources of light to demonstrate that morning has short shadows, noon has longer shadows and night has shortest shadows. They will use their bodies, objects (balls, rulers, etc.) and rotate while observing where their shadows go. Students will create sounds using long, short, and medial lengths of sounds that demonstrate the time of day. Students will create sounds, long and short, that will demonstrate how shadows crescendo and decrescendo throughout the day.

LEARNING TARGETS

“I Can...”

- Create sounds, long and short, that will demonstrate the durations of shadows throughout the day
- Demonstrate how the movement of the light source changes the length of the shadows throughout the day

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DURATION: 3 days

Project Description	Learning Targets
<p>In this project, students will demonstrate durations of light using musical instruments. The students will discover shadows through movement and sources of light to demonstrate that morning has short shadows, noon has longer shadows and night has shortest shadows. They will use their bodies, objects (balls, rulers, etc.) and rotate while observing where their shadows go. Students will create sounds using long, short, and medial lengths of sounds that demonstrate the time of day. Students will create sounds, long and short, that will demonstrate how shadows crescendo and decrescendo throughout the day.</p>	<p>“I Can...”</p> <ul style="list-style-type: none"> • Create sounds, long and short, that will demonstrate the durations of shadows throughout the day • Demonstrate how the movement of the light source changes the length of the shadows throughout the day

ESSENTIAL QUESTIONS

- How can we create sounds that will demonstrate the duration of shadows throughout the day?

STANDARDS

Curriculum Standards	Arts Standards
<p>S1P1 Students will investigate light and sounds. a. Recognize sources of light. b. Explain how shadows are made.</p>	<p>M1GM.4 Improvising melodies, variations, and accompaniments. b. Improvise soundscapes (e.g., weather, animals, and other sound effects).</p>

KEY VOCABULARY

Content Vocabulary
<ul style="list-style-type: none"> • Light • Shadows • Light Sources
Art Vocabulary
<ul style="list-style-type: none"> • Crescendo: gradual increase in volume, soft to loud • Decrescendo: gradual decrease in volume, loud to soft • Forte: loud • Piano: soft • Mezzo: medium soft (piano) or loud (forte) • Duration: how long or short a sound is produced • Dynamics: refers to loud and soft sounds; volume • Largo: long and connected sounds • Staccato: short and detached sounds

TECHNOLOGY INTEGRATION

- <https://www.youtube.com/watch?v=3B7KLstUZbI> (Time Lapse with shadows)
- <http://www.schooltube.com/video/96d3fe1ce9fdeec40269/Tree-Shadow-TimeLapse>
- <http://www.schooltube.com/video/8833edd200a8672040d8/Shadow%20Time%20Lapse>
- https://www.youtube.com/watch?v=99kHBXw0_UM (Mr. Greg's Dynamics)

ASSESSMENTS

Formative	Summative
<ul style="list-style-type: none"> ● Students will be observed when given direct instructions to hear if they can make accurate sounds to create shadows that reflect morning, noon, and night. 	<ul style="list-style-type: none"> ● Students will be able to create notations and perform their sounds of shadows that follow the progression of the day (Morning, Noon, and Night).

MATERIALS

- Slide whistles
- Recorders
- Drawings of the same picture with variations of shadow movement
- Triangle
- Tone bloc
- Gong
- If there are no instruments present at your school, you can substitute vocal sounds with body percussion or found sounds (anything one can find, ex: pencil tapping the desk).

Activating Strategy (5-10 min)

- Watch video of a tree's shadow (see technology for links)
- Listen to parts of **Dvorak's New World Symphony Movements 2, 3, & 4** (in the order of 3, 4, & 2) while looking at a picture of various shadows (see Downloads).
- Ask EQs and review "I Can Statements" to explain to students what this project in the unit is about.

Main Activity**PROCESS:**

Apply the idea of long and short sounds representing shadows through music.

PART 1

- Revisit science vocabulary and introduce music vocabulary.
- Students will create shadows through movement and sources of light to demonstrate that morning has longer shadows, noon has shorter shadows and night has shortest shadows.
- They will use their bodies, objects (balls, rulers, etc.) and rotate while observing where their shadows go.
- The musical element would include different instruments to represent both the time of day and length of shadow:
- Watch videos of shadow progressions and have students describe on chart paper or interactive science journal on the variations of the positions of the shadows based on the main object.
- Morning: Triangle: Represents the longer shadow produced in the morning with a prolonged, high pitched sound that is legato (long and connected). The timbre (sound of the instrument) of the triangle is representative of the bright light of the morning sun.
- Noon: Tone block: Creates short, staccato (short/detached) sound, which represents the length of the noon shadow.

- Evening: Gong or Metallophone (Orff instrument): Creates a warm, long, low (timbre) sound which represents the length of the evening shadow and the time of day.

PART 2

- Listen to **Dvorak's New World Symphony Movements** (see Downloads).
- Students will brainstorm on each movement as to which part of the day it might represent (morning, noon, or night) and where the shadow would be at that part of the day. Each movement will have elements of long, slow, fast, loud, and soft sounds. Just use the first few minutes of each movement.
- Students will look at a basic picture with variations of lights and shadows to discuss which movement would be more likely to go with the picture.
- Students will strike a gong to simulate morning shadow (long), triangle to simulate afternoon (short), and tone block to simulate evening/night (shortest).

Part 3

- Students will create sounds of shadows with the aid of slide whistles and recorders.
- Short blasts of the recorders will simulate short shadows and slide whistles will simulate long shadows.
- This should not be about the quality of the sound, but the durations of each of the sounds to simulate shadows.
- Students with the teacher will come up with notations that represent the time of shadows. (i.e. Long lines=Long shadows=Longer part of the day; Short lines or (any other geometric shape) will represent the shorter shadows and shorter part of the day.
- Students will then discuss what part of the day, morning, noon or night, where shadows are the shortest and longest.

Classroom Tips:

- *With modeling, students should be able to do this at their desk with writing musical notations and performing musical instruments.*

REFLECTION

Reflection Questions

- How does music help you understand how shadows change throughout the course of a day?
- Describe the relationship between the light source and the shadow at specific times throughout the day. In general, why did the shadow grow or shrink?

DIFFERENTIATION

Accelerated:

- Students will create and write individual short and long sounds approved notations on paper for others to follow.
- Advanced students could pretend to have a "pen pal" in different areas of the world (northern vs southern hemisphere or eastern vs western hemisphere, etc).
- They will be given different times of day (morning, when you go to school, lunch time, bed time), and will be asked to predict if they were to message their pen pal, how would the pen pal describe the amount of light at that time.
- Map of the earth and where sunlight is shining: <http://www.die.net/earth/>
- Additionally, students could research what time zone their "pen pal" was in, and what the time difference would be.

Remedial/EL Students:

- Teacher will model “I do, We do, You (Student) do” sounds of long and short shadow sounds.

ADDITIONAL RESOURCES**Websites:**

- <https://www.youtube.com/watch?v=3B7KLstUZbl> (Time Lapse with shadows)
- <http://www.schooltube.com/video/96d3fe1ce9fdeec40269/Tree-Shadow-TimeLapse>
- <http://www.schooltube.com/video/8833edd200a8672040d8/Shadow%20Time%20Lapse>

APPENDIX (See Downloads)

- **Sounds of Shadows Rubric**
- **Dvorak’s New World Symphony Movements Music Files**

CREDITS

U.S. Department of Education




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Sounds of Shadows Rubric

CHECKLIST			
<p>My music had three clearly different parts. In each part, I was demonstrating the various sounds that made shadows. I used long, short, and medial sounds to emphasize the shadows. Long sound = long shadow, Short sound = short shadow, medial sound = middle shadow. These sounds represented shadows at morning, noon, and night.</p>	<p>I simulated all three sounds that represented morning, noon, and night.</p>	<p>I simulated two sounds that represented morning, noon, or night.</p>	<p>I simulated one sound that represented morning, noon, or night.</p>
<p>I verbalized and explained how each length of each sound represented each shadow.</p>	<p>I used the correct vocabulary to explain which sound went with each of the three shadows.</p>	<p>I used the correct vocabulary to explain which sound went with two shadows.</p>	<p>I used the correct vocabulary to explain which sound went with one shadow.</p>
<p>I wrote a complete notation piece that created a musical composition that others could recreate by reading. The notations were in sequence of the day.</p>	<p>I wrote a notation piece that used three different symbols to show the duration of shadows.</p>	<p>I wrote a notation piece that used two different symbols to show the duration of shadows.</p>	<p>I wrote a notation piece that used one symbol to show the duration of shadow.</p>
<p>I worked well with my group. I took turns listening and speaking when brainstorming and rehearsing together.</p>	<p>I worked well with my group and listened to their music and was able to help reproduce it.</p>	<p>I worked well with my group and listened to their music.</p>	<p>I had difficulty listening or reading any of the shadow notations.</p>