

<b>Name:</b> Taking Steps to Solve the Clean Water Challenge: Nya's Long Walk (Elizabeth)	<b>Grade Level:</b> 2nd Grade (preferred experience with Engineering design challenges)	<b>Group Members:</b> N/A
<b>Lesson Title:</b> Integrated STEM Literacy Lesson: <i>Nya's Long Walk</i> by Linda Sue Park	<b>Date:</b>	<b>Time to teach:</b> 3-4 days 45-60 minutes

### CONTEXT FOR LEARNING

#### Central focus and instructional sequence:

This is an integrated STEM lesson focusing on science instruction and the 21<sup>st</sup> century problem of access to clean water. Using children's literature, *Nya's Long Walk*, as a starting point this lesson will guide students to identifying the global challenge that not all people have easy access to clean water, figure out why and how it happens, and brainstorm potential solutions for providing access to clean water. With scaffolding from the teacher, students arrive at designing solar cookers as a feasible solution for access to clean water. Students then engage in background experimental research to determine the best materials for heating water to boiling in a solar cooker. A STEM design challenge is then implemented to develop and test solar cookers in the classroom. The lesson concludes with students

#### Standards:

##### NGSS Science Standards

- K-2 ETS1-1 Ask questions, make observations, and gather information about a situation people want to change and define a simple problem that can be solved through the development of a tool.
- K-2-ETS1-2. Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
- K-2-ETS1-3 Analyze data from tests of two objects designed to solve the same problem to compare strengths and weaknesses of how each performs

##### ELA- Literacy

- CCSS.ELA-Literacy RL 1.3 (describe characters, settings and major events in a story, using key details)

#### Learning objectives:

1. **Students will engage in problem scoping for the Nya's long walk and define a problem**
2. **Students will create a reasonable diagram model for a solar cooker.**
3. **Students will use evidence based reasoning to explain their diagram**
4. **Students will be able to record and communicate observations and measurements**
5. **Students will make claims from evidence**
6. **Students will design, construct and test a solar cooker**

7. Students will determine how their design could be improved in the future.
8. Students will communicate their ideas with classmates
9. Students will give written feedback to peer engineers.

### **Knowledge about my students that influence planning: Academic, cultural, and personal assets:**

**(These should be updated to describe your students.)**

- The students are typical second grade students in the second semester of the school year.
- There are eighteen students in the class.
- The children are a mix of seven and eight years old.
- The classroom teacher shared that the class likes stories, and they have some experience engineering design challenges and working with various materials in small group settings
- Two of the students are English Language Learners.
- The school has participated in a clean water fundraiser and have seen some videos about access to clean water with the whole school

### **Discipline-specific academic language support:**

- Graphic Organizer
- Word Bank
- Call and respond attention getter with science vocab
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### **Learning supports for all (Universal Design for Learning):**

Students will be actively involved during the story when they turn and talk with their partner.

- The teacher will pair students for "Turn and Talk" to minimize distraction and support the ELL student's learning.
- Scaffolding will be provided for students as needed when they are answering questions.

### **Differentiation- individual supports and accommodations:**

- The teacher will use the microphone system to amplify the words for a student who has hearing impairments.
- Some students (especially those wearing masks) feel more comfortable listening to the story from their table seats rather than being close to their peers on the carpet. They can sit at their seats. During "turn and talk," they will be paired with others at a distance or who are willing to mask.
- Graphic Organizer will guide the students learning throughout the lessons

### **Behavior supports and strategies:**

- Students will be working in groups based on teacher recommendations
- Regular classroom behavior supports will apply
- Teacher will use a call and response class attention getter of counting down from five with hands raised students will respond with "Engineers"

## **Assessment plan- evidence of student learning and evaluation criteria:**

### **Taking Steps To Solve the Clean Water Crisis Formative Assessments**

Formative assessments are embedded throughout the unit with written data captures at the end of each lesson.

Objectives: In these formative assessments students will:

1. Explain materials they would use for a solar cooker and why
2. Describe the problem and task
3. Make a claim supported with scientific evidence
4. Draw a picture applying the scientific knowledge learned from the materials investigation.
5. Self-evaluate their solar cooker to ensure its meets necessary criteria.

Instructions:

- Students will complete formative assessment tasks embedded in their graphic organizer logbooks at various points during the lessons as directed by the teacher.
- Students will complete the 1-minute quick write at the end of lesson one and the bottom of page one of the graphic organizer.  
-“Before you can move on to the designing your solar cooker you need to restate the task on the bottom of page 2 of your log book.
- Solar cooker design criteria check: After constructing the solar cooker, but before testing You must complete the three question criteria check to be sure your solar cooker is ready. The criteria check is at the bottom of the log book page 3.
- Solar Cooker Feedback Form: While observing other students present solar cookers students will analyze the success of the solar cooker.

Total Points: Formative assessments will not be graded separately. The completed logbook will be assessed at the end of the entire unit.

Formative Assessments Overview:

Each of the formative assessments will give the teacher information on student learning that will allow them to determine if additional scaffolding or instruction is needed.

1. 1-minute quick write:

At the end of lesson one teachers will gauge students’ understanding what materials make a good solar cooker and why. This will help teachers determine if students are ready for the design challenge.

2. Restate the task: The teacher can determine if the students understand the task and the criteria to successfully complete it.

3. Criteria check is a quick check for understanding of expectations for a successful design challenge.

4. Feedback form allows teacher to see if students can analyze the solar cooker for success.

### **Taking Steps To Solve the Clean Water Crisis Summative Assessment for Knowledge Outcomes**

The summative assessment for knowledge outcome will be collected in the second lesson, the Solar Cooker Materials Fair Test Investigation

Objectives: In these summative assessment students will:

1. Write a hypothesis
2. Record Data
3. Make a claim of which materials would be good for a building a solar cooker supported with scientific evidence
4. Apply knowledge of materials that absorb the sun's heat to an alternative situation.

Instructions:

• Students will complete summative knowledge assessment tasks as they complete the solar cooker materials investigation. (See assignment page in lesson plan).  
 The slide show will guide the students to complete each section of the Investigation. Teacher will model and scaffold as needed to ensure all learners are able to complete the investigation. After students complete the solar cooker materials investigation, they will follow the activity handout and draw a picture responding to the prompt: "Draw a picture below to show an idea of how the materials we tested could help someone stay cool on a hot day."

Total Points: 12 points for the Solar Cookers Materials Test (See rubric below)

Rubric for Lesson 2: Fair Test Investigation

Criteria	Smoke Alarm (1)	Pretty Hot (2)	On Fire! (3)	Points Earned
Records and communicates observations and data (SEP 4)	Student is unable to record of communicate observations	Student records of communicates observations, but they are unclear or incomplete	Student records and communicates observations in a clear and thorough manner using words, pictures, or both	
Makes claims from evidence (SEP 6)	Student is unable to make claims	Student makes claims that are unsupported by evidence	Student makes claims about plans needs from observing patterns in data.	
Demonstrates understanding of fair test (SEP 3)	Student is unable to demonstrate understanding of a fair test.	Student recognizes that the test needs to be fair but cannot identify factors to control.	Student identifies how to design a fair test and can identify controls	
Demonstrates understanding of correct materials that absorb the sun's energy	Picture does not show an understanding of how someone could stay cool on a hot day	Draws a picture that indicates some understanding of how a person could stay cool on a hot day.	Accurately draws a picture that shows how someone could stay cool on a hot day.	
Total				

## Taking Steps To Solve the Clean Water Crisis Summative Assessment for Performance Outcomes

Objectives: In these summative assessments students will:

1. Accurately record the budget of their solar cooker
2. Record Data
3. Make a claim of which materials would be good for a building a solar cooker supported with scientific evidence
4. Analyze success of solar cooker
5. Use scientific evidence to explain how a solar cooker can make water safe to drink.
6. communicate and explain to others their use of the design process to make a solar cooker.

Instructions:

- Students will complete summative performance assessment tasks as they complete the solar cooker design challenge. (See assignment page in lesson plan).

The slide show will guide the students to complete each section of the challenge. Teacher will model and scaffold as needed to ensure all learners are able to complete the challenge. (See log book graphic organizer in lesson plan)

Total Points: 21 points for the Solar Cookers Materials Test (See rubric below)

Rubric for Lesson 1 & 3: Solar Cooker Design Challenge

<b>Criteria</b>	<b>Help needed (1)</b>	<b>Getting Closer (2)</b>	<b>Master Builder! (3)</b>	<b>Points Earned</b>
Records and communicates observations and data	Student is unable to record of communicate observations	Student records of communicates observations, but they are unclear or incomplete	Student records and communicates observations in a clear and thorough manner using words, pictures, or both	
Makes claims from evidence (SEPS 7)	Student is unable to make claims	Student makes claims that are unsupported by evidence	Student makes claims about success of cooker based on observations and evidence.	
Demonstrates understanding of design challenge	Student is unable to demonstrate understanding of a criteria, constraints or a successful design.	Student recognizes criteria and constraints but cannot use them to explain success of solar cookers	Student identifies criteria, constraints and success of solar cookers	

Budget	Budget is incorrect and unreasonable	Budget is reasonable but incorrect or correct but unreasonable	Accurately calculates a reasonable budget	
Completeness and effort	Logbook has many blanks and empty spaces	Logbook is completed with minimal blanks	All sections of the logbook are completed with best effort	
Develop a solar cooker (SEP 2)	Solar cooker does not meet the criteria.	Construct a solar cooker that meets two of the three criteria.	Uses time wisely to construct a sturdy cooker that meets the criteria.	
Communicates information (SEP 8)	Presents the solar cooker and only shares minimal information.	Presents solar cooker to the class sharing budget, and data but is unable to explain materials and the why of the design.	Presents solar cooker to the class sharing budget, data and explains materials, design and why.	
Total				

### Summative performance Assessments Overview:

The Summative performance assessments will be collected by the teacher and scored for completion and with the rubric for accuracy on certain sections. The teacher will also observe the presentation of the solar cooker to the class and observe the students while they are constructing their solar cookers.

### Technology and instructional resources needed:

- Thermometers
- Heat lamps
- Computer and projector
- You could use a document camera to enlarge the book or use a digital version of the book to project

## INSTRUCTIONAL DESIGN:

### Procedures/Order of Teaching/Learning Tasks

**\*\* All Links provided at the bottom of lesson plan\*\***

Day 1

Activity	Instructions and Learning Activity	Materials
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<p>Read aloud 10 minutes</p>	<ul style="list-style-type: none"> <li>● Before reading have students look at the cover of the book and brainstorm predictions</li> <li>● Ask students to listen for challenges that Nya faces in the story.</li> <li>● Record them as they read the story.</li> </ul>	<p><i>Nya's Long Walk</i></p> <p>Student graphic organizer/ log book- This item is critical in guiding the unit and appears in lessons 1 &amp; 3</p> <p>Lesson guiding Slide Deck- This is critical in guiding the unit and appears in all three lessons.</p>
<p>Brainstorm Problems Nya faced. 5 minutes</p>	<ul style="list-style-type: none"> <li>● Class shares out ideas</li> <li>● Generate a list on the white board</li> </ul>	
<p>Introduce Solar Cookers 5 minutes</p>	<ul style="list-style-type: none"> <li>● Begin with scaffolding questions guiding students to solar cookers (slide deck)</li> <li>● National Geographic Video</li> </ul>	<p>Slide</p>
<p>Create Solar Cooker BluePrints</p>	<ul style="list-style-type: none"> <li>● Brainstorm possible materials that could be used for a solar cooker</li> <li>● Draw a detailed, labeled "blueprint"</li> <li>● Define blueprint (Detailed, labeled drawing of solar cooker)</li> </ul>	<p>Student logbook</p>
<p>Wrap up</p>	<ul style="list-style-type: none"> <li>● <u>Formative assessment</u>: Complete a one-minute quick write responding to "What did you do and why?"</li> </ul>	<p>Student logbook</p>

<p><b>Day 2</b></p>		
<p><b>Activity</b></p>	<p><b>Instructions and Learning Activity</b></p>	<p><b>Materials</b></p>

<p>Introduction 5 minutes</p>	<ul style="list-style-type: none"> <li>● Begin with the story about my students in Hawaii practicing for May Day performance on the black top and racing to the cement in between rounds. Students are barefoot. What do you think was happening?</li> <li>● Ask students if they have even been outside on a hot day in a black T-shirt. What happens to the T-shirt? Is it different than a white T-shirt?</li> <li>● As a group write a prediction on a white board explaining this phenomena.</li> </ul>	<p><i>Nya's Long Walk</i></p> <p>Solar cooker Materials Investigation sheet</p> <p>Lesson guiding Slide Deck</p>
<p>Review Solar Cookers 5 minutes</p>	<ul style="list-style-type: none"> <li>● Remember our lesson last time?</li> <li>● Can you think of a connection to the scenario we just described and solar cooker materials.</li> </ul>	
<p>Develop Fair test Investigation as a class 10 minutes</p>	<ul style="list-style-type: none"> <li>● Scaffold a fair test investigation with students for materials <ul style="list-style-type: none"> <li>○ Black paper</li> <li>○ White paper</li> <li>○ foil</li> </ul> </li> <li>● Write a hypothesis</li> <li>● Create a "fill in the blank" procedure as a class</li> <li>● Create a data table as a class</li> </ul>	<p>Fair test investigation sheets Thermometers Black paper White paper foil</p>
<p>Conduct Fair Test Investigation 15 minutes</p>	<ul style="list-style-type: none"> <li>● Record Data</li> <li>● Discuss Data</li> <li>● What do the results tell us?</li> </ul>	<p>Graphic organizer/ Investigation sheet</p>
<p>Wrap Up (CER) 10 minutes</p>	<ul style="list-style-type: none"> <li>● <u>Formative Assessment:</u> Write claim evidence reasoning statement to answer the driving question</li> </ul>	<p>Graphic Organizer/ Investigation sheet</p>

**Day 3 & 4 Design, Make and Test Solar Cooker (2 x 45-50 minute lessons)**

Activity	Instructions and Learning Activity	Materials
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<p>Introduction <i>5 minutes</i></p>	<ul style="list-style-type: none"> <li>● We need to think of a way to test our solar cookers!</li> <li>● Have you ever cooked anything outside of the kitchen?</li> <li>● Think- Pair-Share</li> <li>● S'mores article from scholastic science world (link in slide deck)</li> </ul>	<p>Student logbook</p>
<p>Introduce Criteria and Constraints and how to test <i>5 minutes</i></p>	<ul style="list-style-type: none"> <li>● Read aloud criteria and constraints</li> <li>● Discuss what they mean</li> <li>● Develop a test scale: gooeyness? Temp of marshmallow?</li> <li>● Reference temperatures from Science World Article</li> </ul>	<p>Student Logbook</p>
<p>Background Solar Cooker Info <i>10 minutes</i></p>	<ul style="list-style-type: none"> <li>● Share background solar cooker info slides with class while calling on volunteers complete page two brainstorm/ background boxes</li> <li>● Record responses in Student logbook</li> <li>● <u>Formative Assessment:</u> Criteria Check: Restate the task (bottom of logbook p. 2)</li> </ul>	<p>Logbooks Lesson guiding Slide Deck</p>
<p>Design and Budget <i>10 minutes</i></p>	<ul style="list-style-type: none"> <li>● With your partner decide on the design you want to create</li> <li>● Include a detailed. Labeled drawing of your cooker.</li> <li>● Determine the budget based on the supplies used.</li> <li>● Work though an example together to make sure students understand how to calculate budget.</li> </ul>	<p>Logbook</p>
<p>Construct <i>20 minutes</i></p>	<ul style="list-style-type: none"> <li>● When students can share a completed budget and labeled design, they may collect their materials to begin constructing their solar cooker with partner.</li> </ul>	<p>Foil Tape Saran wrap Cardboard Black paper Skewer Paper bowl Craft sticks Box Other recyclables</p>

Criteria Check	<u>Formative assessment:</u> Complete Criteria Check before storing solar cooker in a safe place until testing day.	Log book
<i>Lesson 3 Day 2: Testing Solar Cookers</i>		
Test Solar Cookers <i>15 minutes</i>	<ul style="list-style-type: none"> <li>● Test and record data</li> <li>● Follow slide deck procedure for testing,</li> <li>● Set up test areas with heat lamp and laundry baskets.</li> <li>● If it is a sunny day- set the test up outside!</li> </ul>	Heat lamps Laundry baskets Skewers Marshmallows Chocolate Graham crackers Stop watches
Share Designs <i>20 minutes</i>	<ul style="list-style-type: none"> <li>● Partners present their solar cookers to the class</li> <li>● Explain design</li> <li>● Share budget and data</li> </ul>	Solar cookers
Engineer Feedback <i>Complete during design share</i>	<ul style="list-style-type: none"> <li>● Write about another classmates design</li> <li>● What did they do well and why?</li> <li>● Complete feedback form for one or more other teams</li> </ul>	Solar cooker feedback forms
Analysis <i>10 minutes</i>	<ul style="list-style-type: none"> <li>● <u>Summative assessment:</u> Complete the back page of the student log book</li> </ul>	Logbook slides
Wrap Up <i>5 minutes</i>	<ul style="list-style-type: none"> <li>● Revisit essential question: Can a solar cooker help solve the clean water crisis? How?</li> </ul>	Slides!

[Taking Steps to solve the Clean Water Challenge Slide Deck](#)

[Clean Water Crisis Student Logbook](#)

[Solar Cooker Materials Graphic Organizer](#)

## RATIONALE/ANALYSIS/COMMENTARY

