

How to Engage Elementary Students in Science?



Newton USD 373 Grades K-4

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Session Outcomes



- Gain ideas on how to focus on science in grades K-4
- Learn about schedules in Newton USD 373
- Observe examples of NGSS lessons
- Observe examples of PLTW lessons
- Collaborate with colleagues about effective lesson design and delivery

How did Newton get to our current model?

- Need for additional plan time for K-4 classroom teachers
- Sought volunteers interested in teaching science as a “specials” class
- Created a schedule that guarantees 90 minutes of science weekly
- Provided initial additional planning time and training for teachers
- Meet monthly for a full day with each other to learn about NGSS lesson delivery

Talking Chips



Each person has two chips. Use one chip at a time to share with the group.

1. What do you currently do in your school?
2. What did you hear that might help you with ideas?
3. How might you be able to modify information learned today to fit your school/district?

Introduction to Project Lead the Way

<https://www.pltw.org/>



Favorite Courses



**Energy: Collisions
2015 JNiehage**

ENERGY: COLLISIONS 2015 JNIEHAGE

Not Showing Grade



**Energy: Conversion
2015 JNiehage**

ENERGY: CONVERSION 2015 JNIEHAGE

Not Showing Grade



**Light and Sound
2015 JNiehage**

LIGHT AND SOUND 2015 JNIEHAGE

Not Showing Grade



**Light: Observing the Sun,
Moon, and Stars 2015 JNi...**

LIGHT: OBSERVING THE SUN, MOON, AND ST...

Not Showing Grade



**Materials Science: Form and
Function 2015 JNiehage**

MATERIALS SCIENCE: FORM AND FUNCTION...

Not Showing Grade



**Materials Science: Properties
of Matter 2015 JNiehage**

MATERIALS SCIENCE: PROPERTIES OF MATT...

Not Showing Grade



Courses

Calendar



Todo

Notifications



Messages

Favorites All Courses

PLTW Design Model

Demonstrate how your design solved the problem and share ideas for ways to improve it.

What is the problem we want to solve?

ask

What skills and knowledge do we need to solve this problem?

explain

Design
Process

explore

Test your idea to see how well it solved (or didn't solve) the problem.

evaluate

model

Select the best design and build a model or prototype.

Kindergarten Structure/Function

K-2-ETS1-1 Ask questions make observations and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

K-2-ETS-1-2 Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it tfunction as needed to solve problem.



Home



PLTW | Launch



Modules



Syllabus



Assignments



Grades



Discussions



Pages



Quizzes



People



Announcements



Conferences



Collaborations



Outcomes



Files



Attendance

- Intro Introduction
- 1 Activity 1: What are Structure and Function?
- 2 Activity 2: Build a Beanstalk
- 3 Activity 3: Straw, Wood, and Bricks
- 4 Project 4: Design a House
- 5 Problem 5: Paintbrush Design
- KT Key Terms



Courses



Calendar



Todo



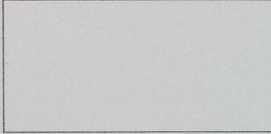
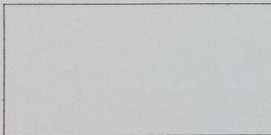
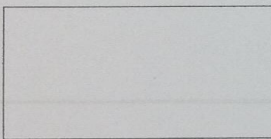
Notifications

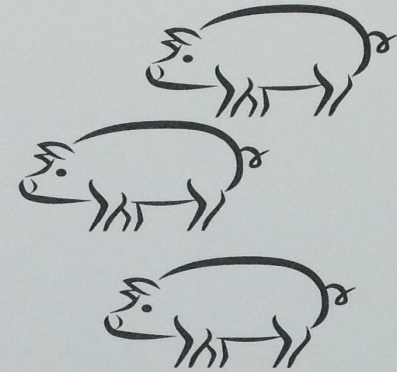


Messages

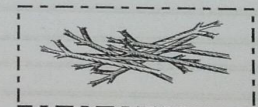
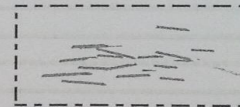
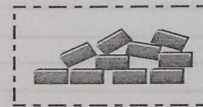
Each of the pigs houses has the same function. What are some differences in the structure of the houses?

Activity 1.3 Straw, Wood, and Bricks

1. 
2. 
3. 



Directions: Cut out the boxes below. Glue them in the order that the wolf tried to blow down the houses. Then mark an X over any material that the wolf was able to blow down.

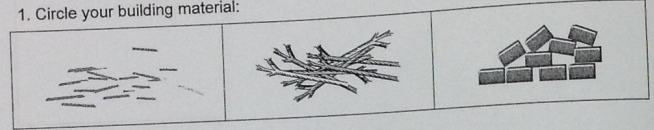


How do you know something has been designed by a person or a team of people?

Project 1.4 Design a House

Directions: Circle the building material you are using to build a house for a pig. In box 2 draw a design for the house that you will build. In box 3 draw the test results, or how the house looked after testing.

1. Circle your building material:



2. Draw your house.

3. Draw your test results.

Two large, empty rectangular boxes are provided for drawing. The left box is for drawing the house design, and the right box is for drawing the test results. Both boxes are currently blank.

Kindergarten students from Mrs. Bartel's class building and testing their finished 3 Little Pigs House. (PLTW Module #2)



1st Grade PLTW Light & Sound



Each Module Covers Many Standards:

Next Generation Science Standards

- 1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate.
- 1-PS4-2. Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.
- 1-PS4-3. Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light.
- 1-PS4-4. Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance.
- K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or 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 the strengths and weaknesses of how each performs.

1st Grade PLTW Light & Sound



Also covers standards in other subject areas through
Common Core State Standard Connections:

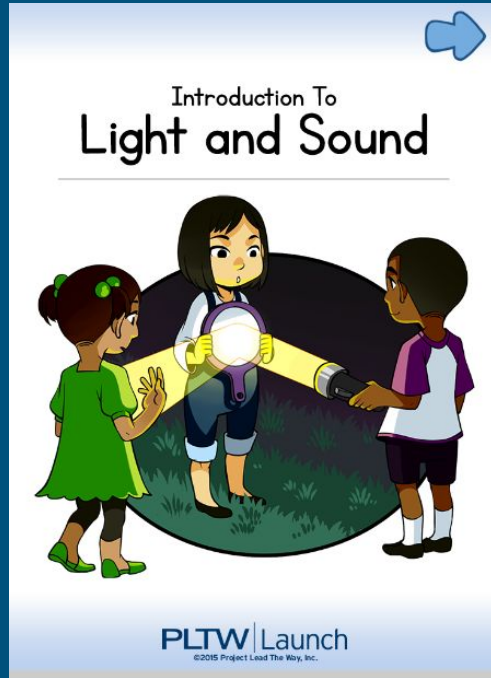
Common Core ELA

- W.1.2 Write informative/explanatory texts in which they name a topic, supply some facts about the topic, and provide some sense of closure.
- SL.1.1 Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups.
 - SL.1.1a Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion).
 - SL.1.1b Build on others' talk in conversations by responding to the comments of others through multiple exchanges.
 - SL.1.1c Ask questions to clear up any confusion about the topics and texts under discussion.
- SL.1.5 Add drawings or other visual displays to descriptions when appropriate to clarify ideas, thoughts, and feelings.
- SL.1.6 Produce complete sentences *when appropriate to task and situation*.

Common Core Math

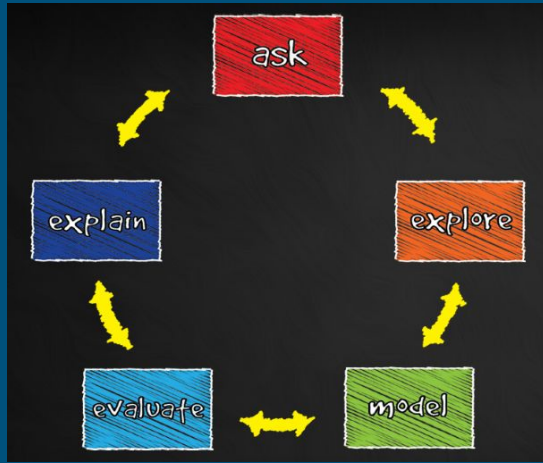
- **1.MD.A.1 Order three objects by length; compare the lengths of two objects indirectly by using a third object.**
- **1.MD.A.2 Express the length of an object as a whole number of length units, by laying multiple copies of a shorter object (the length unit) end to end; understand that the length measurement of an object is the number of same-size length units that span it with no gaps or overlaps.**
- **1.MD.C.4 Organize, represent, and interpret data with up to three categories; ask and answer questions about the total number of data points, how many in each category, and how many more or less are in one category than in another.**

1st Grade PLTW Light & Sound



Each module begins with a fictional story about three friends. The story helps to introduce the problem that students will be trying to solve at the end of the module.





- 1 - Review the Design Process
- 2 - Tuning forks, slinkies, stethoscopes, cups and string
- 3 - Flashlights and mirrors
- 4 - Flashlights, colored lenses, spectroscopes
- 5 - Final Design Project - mirror, flashlight, two plastic cups, a metal water bottle, a bandana, and a roll of tape

PLTW | Launch

Intro

Introduction

1

Activity 1:
Introduction to Light and Sound

2

Activity 2:
Sound

3

Activity 3:
Light

4

Project 4:
Light Investigation

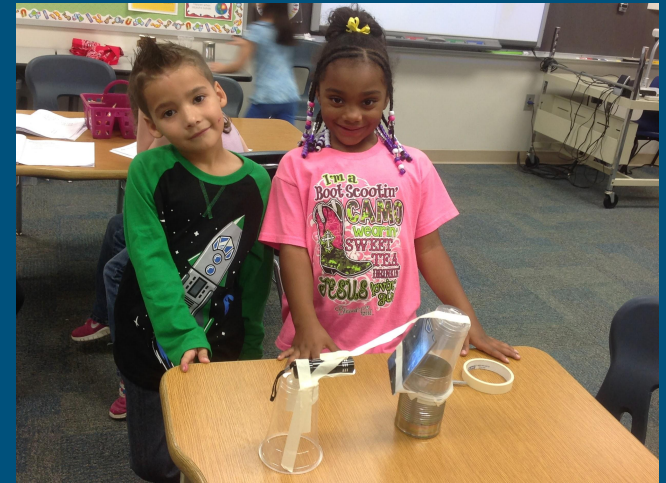
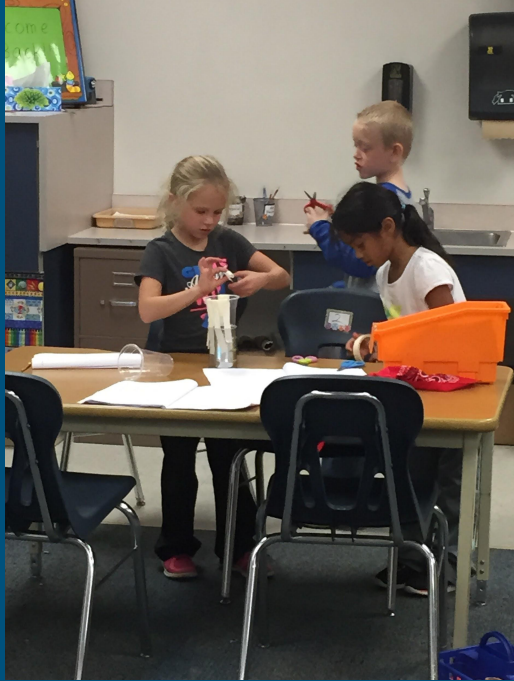
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Problem 5:
Communicating with
Light and Sound

KT

Key Terms

1st Grade PLTW Light & Sound



1st Grade PLTW Light & Sound



Stand Up, Hand Up, Pair Up

- What can you take away from the Kindergarten and First Grade PLTW lessons?
- What ideas did it generate for you?
- What questions do you want to find out yet?



3rd Grade Inherited Traits



3-LS3-1 Heredity: Inheritance and Variation of Traits

Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

3-LS-2 Heredity: Inheritance and Variation of Traits

Use evidence to support the explanation that traits can be influenced by the environment.

Inherited Traits and Learned Behaviors

Introduction

- Give each student an index card before showing the PPT.
- Start with a hook to get them thinking!
- Introduce the Essential Question and New Vocabulary

Inherited Traits and Learned Behaviors

How would you describe yourself?
Make a list of 5 characteristics...

Essential Questions

- How are inherited traits different from learned behaviors?

Vocabulary to Know:

- Inherited trait
- Offspring
- Learned behavior



The Inherited Traits of: _____

Trait	Me	Mom	Dad	Sibling
Dimples	Yes No	Yes No	Yes No	Yes No
Hitchhiker's Thumb	Yes No	Yes No	Yes No	Yes No
Tongue Roll	Yes No	Yes No	Yes No	Yes No
Longer Second Toe	Yes No	Yes No	Yes No	Yes No
Hand Claspings	Right Left	Right Left	Right Left	Right Left
Earlobes	Attached/Unattached	Attached/Unattached	Attached/Unattached	Attached/Unattached
Vulcan Hand Sign	Yes No	Yes No	Yes No	Yes No
Widow's Peak	Yes No	Yes No	Yes No	Yes No
Freckles	Yes No	Yes No	Yes No	Yes No
Cleft Chin	Yes No	Yes No	Yes No	Yes No
Naturally Curly Hair	Yes No	Yes No	Yes No	Yes No
Total Number:	___ Yes ___ No	___ Yes ___ No	___ Yes ___ No	___ Yes ___ No

1. According to the results of the experiment, I am most like my mom/dad/sibling. (Circle One) We share ___ traits.
2. I look more like my mom/dad/one of my grandparents/another relative/other. (Circle One)
3. I act more like my mom/dad/one of my grandparents/another relative/other. (Circle One)

Inheritance and Variation of Traits

Activating Common Core Essentials (AC2E) Lesson

Life Science

Inheritance and Variation of Traits: Life Cycles and Traits (3-LS3-1)

Title:	Heads or Tails Coin Flip Genetics
Performance Expectations:	Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.
Clarification Statement:	Patterns are the similarities and differences in traits shared between offspring and their parents, or among siblings. Emphasis is on organisms other than humans.
Time:	Two one-hour class periods
Resources:	coins to flip, Coin Flip Genetics handout (appendix)
Gathering Information:	<ol style="list-style-type: none">1. Introduce the terms <i>genetics</i>, <i>traits</i>, <i>genes</i>, <i>dominant</i>2. Ask students or groups of students to make a list of traits that are the same between the students and their parents then share their list with the class.3. Explain to the class that each child gets two sets of genes: one set from their mother and one set from their father. This applies to all living things, not just humans. Some traits are more dominant (visible) than others.4. Have students work with a partner to design a plant.<ul style="list-style-type: none">• Each partner will play the role of the mother or the father for the activity.• Students will take turns flipping a coin to determine five traits for their plant and complete the Coin Flip Genetics handout.• Each parent will flip the coin once for each trait. If the mother flips heads and the father flips heads (TT), the offspring will be tall and that will be recorded in the far right column. If the mother flips tails and the father flips heads, the offspring will still be tall since T is the dominant trait.
Reasoning:	Students will draw the plant they created. The drawing must include the traits that were determined by the coin flips and an original name for the plant. The handout and the two drawings should be posted together.
Communicating:	<ol style="list-style-type: none">1. Have the students go around the room looking at their classmates' drawings of their plants.2. In their science journals, have students write a paragraph explaining what the simulation of flipping a coin to determine genetic traits has in common with how traits are passed from parent to offspring.

Mystery Science

<http://mysteryscience.com/animals/mystery-5/heredity-variation-selection/25?r=1334587>

The screenshot displays the Mystery Science website interface. On the left, a navigation menu lists grade units: 'K-1 Grade (pilot begins 2016-2017)', '2nd Grade Units (ages 7 & 8)', '3rd Grade Units (ages 8 & 9)' (highlighted in purple), '4th Grade Units (ages 9 & 10)', and '5th Grade Units (ages 10 & 11)'. Below this, it states 'NGSS-ALIGNED FOR 3RD GRADE' and lists two units: 'Animals Through Time: Habitats, Heredity, & Change Over Time' (with an NGSS icon) and 'Plant Adventures: Life Cycles, Traits, & Adaptations' (with an NGSS icon). The main content area features the 'Animals Through Time' unit page, which includes social media icons (Pinterest, Twitter, Facebook), a description: 'This is a 5-week unit where students will develop an appreciation for how animals and the places they live (their habitats) are... More', and a navigation bar with tabs for 'Lessons', 'Activity Prep', 'Standards', and 'Assessments'. The 'Lessons' tab is active, showing 'Mystery 1: Habitats & Environmental Change' with social media icons, the title 'Where can you find whales in a desert?', and two activities: 'Exploration (15 min)' and 'Activity: Guess the Habitat (30 min)'. A blue-tinted image of a whale is visible on the right side of the lesson page.

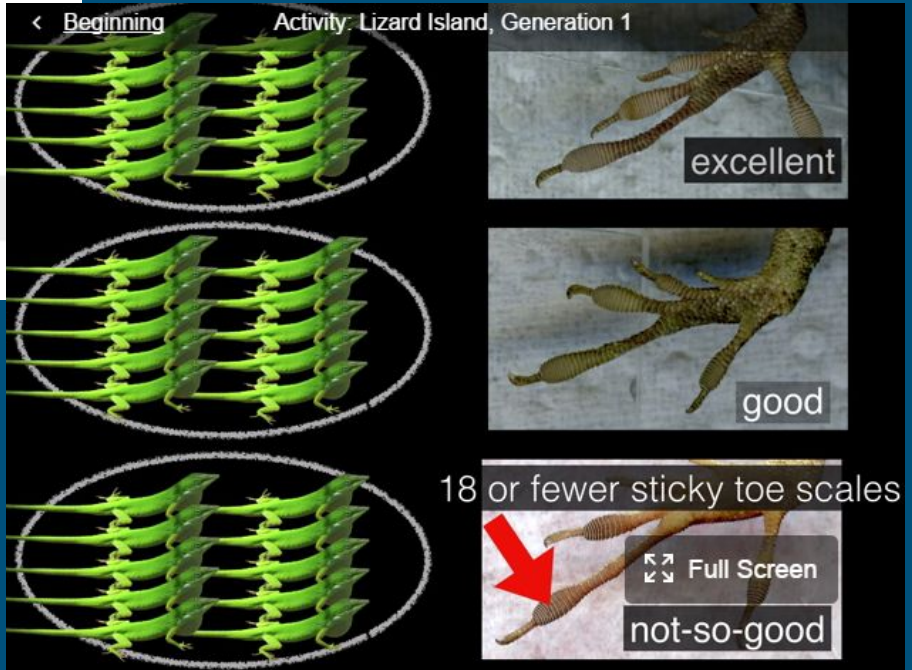
Predict: What do you think might have happened to the green anoles, once the brown anoles arrived in Florida and started to get hungry?

💡 Reveal answer

Predict: Not all of the green anoles are exactly the same. Which green anoles do you think the brown anoles are most likely to catch?

💡 Reveal answer

< Beginning Activity: Lizard Island, Generation 1



The image displays three panels of green anoles in a circular arena, arranged vertically. To the right of these panels are three panels showing close-ups of lizard feet with sticky toe scales. The top panel is labeled "excellent", the middle panel is labeled "good", and the bottom panel is labeled "not-so-good". A red arrow points to the bottom panel, which also has the text "18 or fewer sticky toe scales" above it. A "Full Screen" button is visible in the bottom right corner of the image area.

excellent

good

18 or fewer sticky toe scales

not-so-good

Full Screen

ADOPT A LIZARD

Count the scales on the big toe.



My lizard's toe has _____ scales.

Circle the kind of climber this lizard is:

23 or more scales =
Excellent Climber

19 to 22 scales =
Good Climber

18 or fewer scales =
Not-So-Good Climber

Does your lizard survive? Yes! No

A

What do the graphs from each generation tell you about how the genetics or inherited traits of the lizards have changed?

HOW MANY LIZARDS?

GENERATION 1: ORIGINAL LIZARDS

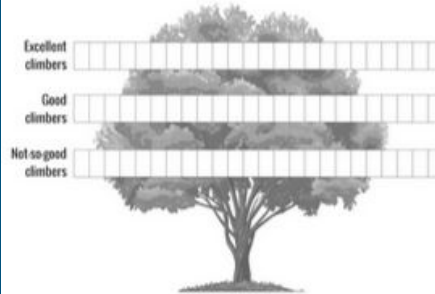
When brown lizards came to the island, the green lizards could climb trees. But some green lizards were better climbers than others.

There are _____ excellent climbers

There are _____ good climbers

There are _____ not-so-good climbers

To make a bar graph, color in a box for each lizard.



GENERATION 2: BABY LIZARDS

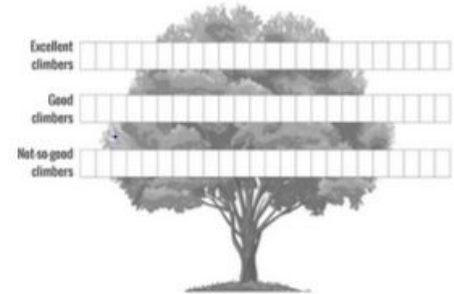
This is what the green lizard babies were like after the brown lizards arrived.

There are _____ excellent climbers

There are _____ good climbers

There are _____ not-so-good climbers

To make a bar graph, color in a box for each lizard.



✓ In the group of parent lizards, there were as many not-so-good climbers as there were excellent climbers. In the group of baby lizards there are now *more* excellent climbers, and fewer not-so-good climbers.



Want to know more about how scientists study lizards?

- [Read about Todd Campbell and Yoel Stuart](#), the scientists who studied lizards on Lizard Island.
- Watch biologist Jonathan Losos demonstrate [how to catch a lizard](#) using a tiny loop of string on a stick.
- Watch Jonathon Losos test the abilities of different types of lizards in a [Lizard Olympics contest](#).

Optional Extras

Below are ideas for extending this topic beyond the activity & Exploration which you just completed.

- [Written Response Questions](#) and [Answer Key](#)
- **Reading:** [Scientists of Lizard Island](#) introduces Todd and Yoel, the scientists who studied the lizards of Lizard Island.
- **Bonus Mystery:** [Why do some animals live in groups?](#)
- **Activity:** A bowl of candy helps students understand how a group of animals changes over time in a hands-on activity called [Candy Dish Selection](#).
- **Activity:** This [hands-on activity](#) lets student see how natural selection resulted in birds with beaks of different sizes and shapes.

4th Grade-Natural Resources

4-ESS3-1: Students can obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

4-ESS3-2: Students can generate and compare multiple solutions to reduce the impacts of the natural Earth processes on humans.

Science vocabulary to use and teach

Renewable Resource: Resource that is readily available and will not run out

Nonrenewable Resource: Resource that takes millions of years to form and cannot be replenished

Solar Energy: Light from the sun converted to energy

Geothermal Energy: Heat inside the earth

Wind Energy: Energy created using the wind

Fossil Fuel: Nonrenewable resource made from dead plants and animals

Petroleum: a fossil fuel, oil

Natural Gas: a fossil fuel, mixture of different gases

Coal: a fossil fuel, shiny black rock burned to create energy

Reduce: Using less to conserve resources

Reuse: Using things more than once to save resources

Recycle: Breaking down materials so they can be made into something new

Questions and Background to Review Before Activity

What are natural resources?

What is coal and how is it used? Coal provides lots of energy, burned it makes heat and light energy. Coal is used in trains and ships for fuel. It is mainly used to make electricity. It causes lots of pollution. 37% of our energy is from coal.

What is petroleum and how is it used? Commonly called oil and makes gasoline. Without this we would not be able to run cars, trucks, and planes. It is also used to make paint, medicine, and soap. This is our most used energy source. It causes pollution in the air, water, and soil.

What is Natural Gas and how is it used? It is burned to make heat and electricity. Natural gas is used to heat homes, schools, water heaters, stoves and ovens. It is an ingredient in paint, glue, plastic, fertilizers, and medicine. It is the cleanest natural resource to burn.



Doing the Activity

Divide students up into groups of 5. Each group of students will be given a tub with sand and five colors or beans. Each bean represents a different natural resource, some renewable others nonrenewable. Nonrenewable resources will have a smaller amount of beans added to the tub. They will each collect their assigned resource for three one minute intervals. Renewable resources will be replenished after each interval.

Students do research using QR codes. Then teams give a report to the whole class.




Tesla Town is an I-Pad app that allows students to explore the energy needed to supply a town.



WELCOME TO TESLA TOWN!

Welcome to Tesla Town! Here you can explore electricity and how it's made. Most of the electricity that powers lights and appliances in our homes and schools is produced when magnets spin inside coils of wire. Often, high pressure steam pushing across turbine blades causes the spinning. Although sometimes wind or moving water are used to turn the turbines. Your force can make a turbine turn when you visit the school in Tesla Town.

Explore Tesla Town by tapping on the structures. Have fun, and if you need a hint, tap the  button and I'll come at the speed of light!

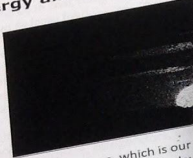


Extra lesson resources

ReadWorks

What is Energy and Where Does it Come From?

What is Energy and Where Does it Come From?



All of our energy comes from the sun, which is our huge amounts of energy through its rays every day. Without the sun, life on our planet would be totally frozen.

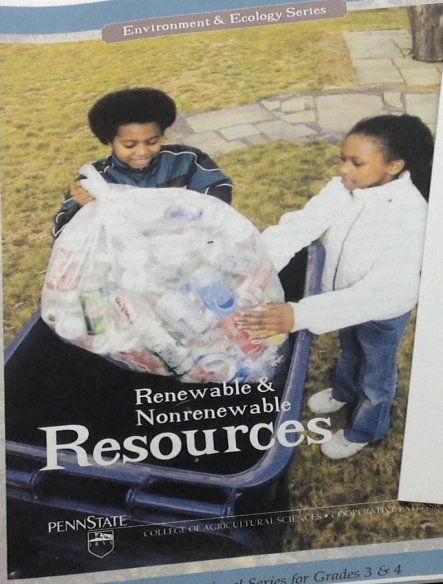
We use this solar energy in many different ways. It warms us.

Plants use the light from the sun to grow. They use a process called photosynthesis. The energy is stored in their leaves. This energy feeds every living thing on the planet. Animals eat plants, and the food made from plants is used in our muscles and in our brain cells.

We use this energy for everything we do. We use it to think, to play, to work, to learn, to move, to think a thought, tell a joke, climb a ladder, make things, and to live.

ReadWorks.org THE SD 2015

Environment & Ecology Series



Renewable & Nonrenewable Resources





PENN STATE COLLEGE OF AGRICULTURAL SCIENCES & COOPERATIVE EXTENSION

An Educational Series for Grades 3 & 4

















Teacher

Natural Resources

NONRENEWABLE **RENEWABLE**

 Fossil Fuels	 Minerals	 Plants	 Animals
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Everyday Items Made from Natural Resources

6

LESSON 1. RENEWABLE OR NONRENEWABLE?

Jot Thoughts

- Share with a colleague something you learned today
- What are you going to implement?
- What are you still wondering about?



Q & A



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Students from Mrs. Smith's class with their finished project (PLTW Module 1)



Students from Mrs. Smith's class with their finished project (PLTW Module 1)



Students in Mrs. Bartel's class learning about properties of matter and testing their coolers. (PLTW Module 1)



