STEAMing our way to Success!

Students make claims and use evidence in STEAM integrated units at Lincoln Acres Elementary
National School District

Lincoln Acres Elementary School

1st Grade: Melissa Kruse (mkruse@nsd.us)

5th Grade: Melissa Kwan (mleekwan@nsd.us)
Jessica Newkirk (jnewkirk@nsd.us)

6th Grade: Jackie Ma (jma@nsd.us)
### Student ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>This school</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic</td>
<td>90%</td>
</tr>
<tr>
<td>Asian</td>
<td>2%</td>
</tr>
<tr>
<td>Black</td>
<td>2%</td>
</tr>
<tr>
<td>White</td>
<td>2%</td>
</tr>
<tr>
<td>Two or more races</td>
<td>1%</td>
</tr>
</tbody>
</table>

*Source: CA Dept. of Education, 2013-2014*

### Student subgroups

<table>
<thead>
<tr>
<th></th>
<th>This school</th>
<th>District average</th>
<th>State average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students eligible for free or reduced-price lunch program</td>
<td>76%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>English language learners</td>
<td>62%</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Source: CA Dept. of Education, 2013-2014*
Strategies Used for STEAM Instruction

- Whole Group Discussion and Teacher Prompts
- Organic Content Vocabulary
- Claim, Evidence, and Reasoning
Claim, Evidence, Reasoning

- **Claim**: Answers the focus question.
- **Evidence**: Observations from hands on investigations.
- **Reasoning**: Explains how the evidence supports the claim and often includes scientific principles.
Plan for productive discussions and notebook use throughout the learning process

- Access prior knowledge
- Examine and process data
- Make sense of data and explain with evidence
- Reflect and connect
Science
1-LS-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Students will read informational text closely to learn how animals use external parts to survive.

Students will work with a team to design a solution to a human problem and create a commercial to sell their product.

Writing
W.1.1 Write opinion pieces in which they introduce the topic, state an opinion, supply a reason for the opinion, and provide some sense of closure.

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.

Reading
RI.1.2 Identify the topic and retell key details of a text.

RI.1.5 Know and use various text structures and text features to locate key facts or information in a text.
Which Beak is Best?

Students investigate before researching and learning key terms.
Students collect, analyze, and interpret data.

**Table: What Kind of Food Can this Bird Eat?**

<table>
<thead>
<tr>
<th>Type of Food</th>
<th>Nectar</th>
<th>Worms</th>
<th>Insects</th>
<th>Fish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spoon</td>
<td>No</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Straw</td>
<td>Yes</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Pliers</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Clothespin</td>
<td>No</td>
<td>yes</td>
<td>no</td>
<td>yes</td>
</tr>
</tbody>
</table>

**Diagram: What Foods do These Birds Eat?**

**Question:** Why do birds have different shaped beaks?

**Answer:** Birds have different shaped beaks because they get their own food.
Alex

Bird beaks

Have you herd that bird beaks can be use as tools. The shape of the beaks help different ways huming birds beaks help them to reach their food. Cardinals have different beaks than the owls. Ducks eat tiny water plants. Now you know that bird beaks are like tools.
Vocabulary is introduced organically and added to notebooks

<table>
<thead>
<tr>
<th>Topic: Animal Adaptations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Word:</strong></td>
</tr>
<tr>
<td>camouflage</td>
</tr>
<tr>
<td>prey</td>
</tr>
<tr>
<td>mimicry</td>
</tr>
</tbody>
</table>

---
Students use chromebooks to research and record adaptations.

<table>
<thead>
<tr>
<th>Body Parts</th>
<th>Body Coverings</th>
<th>Behaviors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Spotted fur coat</td>
<td>Helps it camouflage</td>
</tr>
<tr>
<td></td>
<td>Claws</td>
<td>Helps it climb</td>
</tr>
<tr>
<td></td>
<td>Short teeth</td>
<td>Helps it hunt for food</td>
</tr>
<tr>
<td></td>
<td>Black fur</td>
<td>Helps it blend in</td>
</tr>
<tr>
<td></td>
<td>Sharp teeth</td>
<td>Helps it hunt for food</td>
</tr>
<tr>
<td></td>
<td>Long legs</td>
<td>Helps it run</td>
</tr>
<tr>
<td></td>
<td>Big paws</td>
<td>Helps it walk</td>
</tr>
<tr>
<td></td>
<td>Whiskers</td>
<td>Helps it sense its environment</td>
</tr>
</tbody>
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<th>Body Parts</th>
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<tr>
<td></td>
<td>Nose</td>
<td>Helps it smell</td>
</tr>
<tr>
<td></td>
<td>Claws</td>
<td>Helps it climb</td>
</tr>
<tr>
<td></td>
<td>Sharp teeth</td>
<td>Helps it hunt for food</td>
</tr>
<tr>
<td></td>
<td>Short claws</td>
<td>Helps it grip</td>
</tr>
<tr>
<td></td>
<td>Long arms</td>
<td>Helps it reach</td>
</tr>
<tr>
<td></td>
<td>Long legs</td>
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<td></td>
<td>Fur with bright colors</td>
<td>Helps it attract mates</td>
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<tr>
<td></td>
<td>Unique markings</td>
<td>Helps it hide</td>
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<td></td>
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<td>Huge strong body</td>
<td>Helps it survive</td>
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<tr>
<td></td>
<td>Soft fur</td>
<td>Helps it keep warm</td>
</tr>
<tr>
<td></td>
<td>Colorful feathers</td>
<td>Helps it attract mates</td>
</tr>
<tr>
<td></td>
<td>Hard beak</td>
<td>Helps it crack nuts</td>
</tr>
<tr>
<td></td>
<td>Long legs</td>
<td>Helps it search for food</td>
</tr>
<tr>
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</tr>
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<td></td>
<td>Sharp claws</td>
<td>Helps it hunt</td>
</tr>
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</table>
Student teams make a plan, then do more research to enhance their understanding.

< initial plan

new > understanding
5th Grade

Science
5-LS11 Support an argument that plants get the materials they need for growth chiefly from air and water.

Students will gather information from articles in addition to their investigations to serve as evidence for their claim.

Project
Students will use content vocabulary to annotate their drawings.

Students will conduct investigations to discover what plants need most to grow. Then, they will create a Google Slides presentation to publish their claim and evidence.

Writing
W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

d. Use precise language and domain-specific vocabulary to inform about or explain the topic.

W.5.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.

Reading
RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
Focus Question:
What do plants need most to grow?

Table #4
**Investigation 4: Do plants need sunlight most?**

<table>
<thead>
<tr>
<th>Claim (before the investigation)</th>
<th>I claim that plants need sunlight least.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials:</td>
<td>2 cups, soil, and cress seeds.</td>
</tr>
</tbody>
</table>

**Procedures:**
First, we put cress seeds in the cup.  
Next, we put water so it can grow.  
Then, we put the light one next to the window and the other one we put it in the closet.  
Last, we took it out and observed it.
Using the results of the investigation, write a claim with your partner and support it with evidence.

I claim plants need/do not need light to grow because Evidence.

Because Evidence, plants need/do not need light to grow.
Claim (after investigation): Before the investigation, I thought cress needed sunlight least. Now I know plants need sunlight third.

Evidence:

From the investigation I learned that plants don’t need sunlight most because we put it in the closet and it still grew.

From the article I learned that plants don’t need sunlight most because they think they’re under the soil and grew taller. Chlorophyll is to produce a green color. Without sunlight, the chlorophyll isn’t made. In the dark they go through etiolation which is a yellow color.

Resources: The title is called “What is Etiolation” by Niki Foster.
**Investigation 1: Do plants need air most to grow?**

<table>
<thead>
<tr>
<th>Claim (before the investigation): I claim that plants need air the least to grow.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials: - soil - milk cartons - 2 lima beans - water - petroleum jelly</td>
</tr>
</tbody>
</table>

**Procedures:**
First we planted the 4 beans. After we put petroleum jelly on “All,” “bottom,” and “top” of the leaves and had one “control” without any petroleum jelly. After a few days we checked the plants then we took notes about how they changed.
Claim (after investigation): Before the investigation, I thought plants needed air least. Now I know plants need air second most.

Evidence:

From the investigation, I learned when we put jelly on the leaves then the air could not go through the leaves so the leaves started to die.

From the pages 92 and 93 of *California Science*, I learned that plants do need air because if they don’t have air they die. They breathe through the stomata on the leaves and we covered the stomata with jelly. Plants also make their own food with photosynthesis. Photosynthesis is when a plant breathes and makes its own food.

Resources: *California Science* textbook
Investigation 2:
Do plants need water most to grow?

Claim (before the investigation);
I claim that plants need water most to grow.

Materials:
- soil
- clear cups
- 2 lima beans

Procedures:
First, we observed the lima beans. Then, we took detailed notes with annotated drawings. Then, we labeled the milk carton with our name and our table number on it. Then we put the soil into the milk carton. Finally, we placed the 2 lima beans into the milk carton and covered it with soil. We gave one cup water and didn’t give the other water.
Claim (after investigation):
Before the investigation, I thought plants need water the most to grow now
I know plants need water the most.

Evidence:
My first piece of evidence is in investigation 2 the water plant grew but
the no water one didn’t. Second, Anne Goetz states that with the water the seed
coat breaks down and then the plant grows and that’s called germination.
Finally, in the Discovery Channel video, we saw the seed coat and with the water.
It broke down and the embryo started growing.

Resources:
We watched a video call Discovery Channel video and read an article called “Facts for
Kids on Germination” by Anne Goetz
**Investigation 3:**
**Do plants need soil most to grow?**

<table>
<thead>
<tr>
<th>Claim (before the investigation): I claim that plants need soil most to grow.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Materials:</strong></td>
</tr>
<tr>
<td>- 1 cup</td>
</tr>
<tr>
<td>- 1 ziplock bag</td>
</tr>
<tr>
<td>- paper towel</td>
</tr>
<tr>
<td>- cress seeds</td>
</tr>
</tbody>
</table>

**Procedures:**
1. Label a cup with the table number
2. Wet paper towel
3. Fill cup half way
4. Put towel in ziplock bag
5. Sprinkle/Put cress seeds
6. Do observations always write annotated notes
Claim (after investigation): Before the investigation I thought that plants needed soil most. Now I know plants need soil least.

Evidence:

From the investigation, I learned that plants really don’t need soil because we did an experiment and we used a paper towel with no soil and it grew. Plants really don’t need soil.

After mixing the soil with water, I learned that soil has different layers. The humus layer is the one with the nutrients in it.

From the article “Can Plants Grow Without Soil” I learned that the plants already had its nutrients from the endosperm. I also learned that hydroponics is a way to grow plants without soil. Hydroponics uses water with nutrients instead.

Conclusion:

After all the investigations and readings, we now know that plants get most of their nutrients from water and air to grow. However, to stay healthy, plants still need sunlight because they can’t live without sunlight forever.

*At home investigations*
Science
MS-PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
MS-PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
MS-PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.
MS-WTS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Math
6. PS.1 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answer.
6. PS.2 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.
6. PS.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.
6. PS.5 Summarize numerical data sets in relation to their context.

After learning about heat transfer, students will work in teams to design, build, and test a thermos that will keep water within 10 degrees over a length of 15 minutes.

Students will take measurements of the temperature change of their materials and graph it using Google Sheets.

Students will collaboratively create a Google Slides presentation to share their learning and the results of their thermos designing and testing.

Writing
6. W.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
   a) Introduce a topic or thesis statement; organize ideas, concepts, and information, using strategies such as graphics, and multimedia when useful to aiding comprehension.
   d) Use precise and domain-specific vocabulary to inform about or explain a topic.
6. W.6 Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.
Kinetic vs. Potential Energy

Demos:
1. Ball toss - kinetic energy
2. Rolling Ramp - potential energy
3. Rubber band - kinetic energy

I claim that kinetic energy is the energy of an object when it's bouncing or moving or any sudden movements. My evidence for this explanation is that when Ms. ma let go of the rubber band it was kinetic and when it fell it slowed.

Interpretive dance
I claim that kinetic energy is the energy of an object when it is up in the air and not moving. My evidence for this explanation is when it is in the air and moving and the et-that showed like the ramp.

I claim the potential energy is the energy of an object when it is not moving. My evidence for the explanation is when the ball went down the ramp and it stop and that was potential.
Thermal energy transfer: conduction, convection, radiation
Thermal energy transfer: conduction, convection, radiation

<table>
<thead>
<tr>
<th>Station</th>
<th>Heat Transfer</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher demonstration: A cup of hot tea and the air around it.</td>
<td>The thermal energy is transferring between hot water and the air by convection because convection uses fluid to gas. And the heat source is the water and the air is hot sink.</td>
<td>![Model diagram for convection]</td>
</tr>
<tr>
<td>Station 1: A heating pad and your hand.</td>
<td>The thermal energy is transferring between the heating pad and your hand by convection because you are touching the heating pad, and the heat from the heating pad is heating your hand.</td>
<td>![Model diagram for convection]</td>
</tr>
</tbody>
</table>

Diagram for Conduction:
- Heating pad
- Hot water or air blowing
- Standing on the hot floor
- Using a blanket at night
- Using a microwave to make pizza
- Using a microwave to bake cookies
- Opening a hot air balloon
- Ice cream melting on a hot day
- Waving hand on a hot grill

Diagram for Convection:
- Sunlight
- Radiation
- Hand (not touching)

I know because solid objects are conduction, liquid or gas is convection, and radiation is when you’re not touching it but you still feel it.
Student presentations, results, and graphs
STEAM Resources

Contact information:
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6th Grade: Jackie Ma (jma@nsd.us)

Jessica Newkirk (jnewkirk@nsd.us)

-The Teaching Channel (view videos by subject)
https://www.teachingchannel.org
-Collaboration of Teachers and Artists Program - CoTA (arts integration ideas)
http://cotaprogram.org/
-Science Notebooks (learn about key features and view examples)
http://www.sciencenotebooks.org/
https://www.fossweb.com/science-notebooks
-Prezi (free presentation software)
http://prezi.com
-NGSS Aligned Lessons
http://www.resa.net/curriculum/curriculum/science/professionaldevelopment/ngss-pd/lesson-plans-exploring-ngss/
-Science Notebooks: Writing About Inquiry by Lori Fulton and Brian Campbell
Available on Amazon $20
-Read Works (k-12 reading passages, comprehension, skill & strategy units)
http://www.readworks.org/
-News ELA (Nonfiction literature)
https://newsela.com/

1st Grade

Science
1-LS-1 Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

Reading
RL.1.2 Identify the topic and retell key details of a text.
RL.1.5 Know and use various text structures and text features to locate key facts or information in a text.

Writing
W.1.1 Write opinion pieces in which they introduce the topic, state an opinion, supply a reason for the opinion, and provide some sense of closure.
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.

Students will write opinion pieces to explain why their product is useful.
Students will work with a team to design a solution to a human problem and create a commercial to sell their product.
Students will read informational text closely to learn how animals use external parts to survive.
6th Grade

Science

5-LS1.1 Support an argument that plants get the materials they need for growth chiefly from air and water.

Students will gather information from articles in addition to their investigations to serve as evidence for their claim.

Reading

RI.5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

Project

Students will conduct investigations to discover what plants need most to grow. Then, they will create a Google Slides presentation to publish their claim and evidence.

Students will use content vocabulary to annotate their drawings.

Writing

W.5.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. Use precise language and domain-specific vocabulary to inform about or explain the topic.

W.5.6 With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.

Math

M.5.A.3 Recognize a statistical question as one that anticipates variability in the data related to the question and accounts for it in the answer.

6. PS.1 Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape.

6. PS.4 Display numerical data in plots on a number line, including dot plots, histograms, and box plots.

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Students will take measurements of the temperature change of their materials and each it using Google Sheets.

After Learning

about heat transfer, students will work in teams to design, build, and test a thermometer that will keep water within 10 degrees over a length of 15 minutes.

Students will collaboratively create a Google Slides presentation to share their learning and the results of their thermos designing and testing.

Writing

6. W.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. Introduce a topic or text by providing an overview of the topic or text and organizing it into categories. Use a variety of sentence types and a readable font size.

6. W.6 Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others.