FOURTH GRADE GARDEN BASED CURRICULUM

Table of Contents

UNIT 1: Chicken Unit

Unit Summary:
In this unit, students will learn about the different breeds of chickens we have at school, weigh and classify chicken eggs, and interpret chicken idioms.

Lesson Summaries:

Lesson 1 ~ Researching Chicken Breed
Teacher introduces idea of different chicken breeds and tells students what breeds we have at Manzo. Students go to the computer lab to research a specific breed of chicken and take notes.

Lesson 2 ~ Writing about Chicken Breeds
Students will use their notes from the previous session to write a brief report about the breed of chicken they researched.

Lesson 3 ~ Classifying and Plotting Eggs by Weight
Students will weigh a sampling of actual chicken eggs from our coop, classify them by their weight, and create a mathematical poster about their findings.

Lesson 4 ~ Chicken Idioms
Students read, discuss, and interpret a variety of idioms involving chickens.

Chickens

Lesson 1 ~ Researching Chicken Breeds

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**(4.W.7)** Conduct short research projects that build knowledge through investigation of different aspects of a topic.
Ecology Objective:	•Students will gain knowledge on the specific breeds of chickens at our school.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •Why would someone want a diverse flock of chickens? **Culture** refers to the language, values, and beliefs that people use to perceive and interact with their surroundings: The biodiversity and climate of a region are interconnected with the region's culture. •How do domesticated animals fit in our culture?
Content Objective: *Math Reading* *Writing* *Other:*	•Students will research and take notes on different aspects of breeds of chickens at Manzo.
Language Objective:	

Vocabulary	**Materials**
Docile, confinement, broody, heritage, forage	•Informational library books about chickens •World map •Chicken diagram (see accompanying documents)

Seasonality: This lesson/unit would work during any season, as it is not reliant on any natural phenomenon. However, chickens lay more eggs in warmer months.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: What category does your fact best fit into?
What text features are you using to help you find the answers to your questions?
Using your own language, what's the most important thing you learned about _____ aspect of this breed of chicken?

Anticipatory Set:
Thinking about the chickens we have at Manzo, complete the chart below:

Interesting Facts I know about chickens	Questions I have about chickens

Activity/Investigation:

1. After discussing Anticipatory Set responses…Tell students that today they will embark on a unit in which they will study chickens. Tell them that today, they will specifically do research and take notes about chickens. Inform students a bit about chickens and the various breeds there are. Tell students that chickens are domesticated animals that people have used as farm animals for thousands of years. Chickens are believed to have been domesticated from red jungle fowls from Asia. Tell students that we have _____ breeds of chickens (ask Wes or Moses) and that today, students will select a breed and do some research about that breed.

2. Next, take students outside and show them the basics of how you can identify the breeds we have. Alternatively, you may show them pictures of the various breeds.

3. Back in the classroom, put students into partnerships and either assign them a breed of chicken or allow them to choose themselves. Tell students that in their research today, they will read and take notes on the following aspects of chickens:

-origin and history
-special characteristics of this breed
-habitat
-eggs
-diet

Show students the books you have for them to use as research. Show students a couple websites (see below) and point out how the websites are organized for easy research.

http://www.mypetchicken.com/chicken-breeds/breed-list.aspx
http://www.small-farm-permaculture-and-sustainable-living.com/types_of_chickens.htmlhttp://www.ansi.okstate.edu/breeds/poultry/chickens/
http://www.hobbyfarms.com/farm-breeds/poultry_chickens_all_landing.aspx

4. Have students designate space in their notebooks for note-taking by writing the topic headings (see step 3) atop each page. Remind students that they are taking their own notes—not plagiarizing. Model how to read a paragraph or section of a book or webpage, close the book/turn off the computer monitor, and write down important facts on the corresponding page of their notebooks. Tell students they can check the spelling once they've written their ideas and reopened the book/turn on the monitor. Tell students that each member of their partnership is to take turns reading aloud, but both students write their own notes.

5. Preview common vocabulary words with students. Direct students' attention to a world map they can reference to see origins of their breed of study. Direct students' attention to the posted chicken diagram (see accompanying documents) that they may reference during their research as well.

6. Take students to the computer lab to research and take notes for about ½ hour.

Closing:

Upon return to class, have all partnerships regroup in specific areas based on chicken breed. Students will take turns telling the group the most interesting thing they learned about their breed of chicken. If they have unanswered questions, they may also ask that to their group. Students should bring their notebooks with them to reference facts and to write down new ones. Once groups have had enough time to share, ask each group to share the most unique thing they learned about their breed of chicken.

Teacher Reflection:

Chickens

Lesson 2 ~ Writing about Chicken Breeds

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4.W.2** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
Ecology Objective:	•Students will share their knowledge of specific breeds of chickens through writing.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •Why would someone want a diverse flock of chickens? **Culture** refers to the language, values, and beliefs that people use to perceive and interact with their surroundings: The biodiversity and climate of a region are interconnected with the region's culture. •How do domesticated animals fit in our culture?
Content Objective: *Math Reading* *Writing* *Other:*	•Students will write a report on a specific chicken breed. The report will include an introduction, details, linking words, precise, domain-specific vocabulary, and a conclusion.
Language Objective:	

Vocabulary	**Materials**
	•Graphic organizer

Seasonality: This lesson/unit would work during any season as it is not reliant on any natural phenomenon.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: Do your paragraphs have the proper organization (topic sentence, supporting details, closing sentence)?
Which domain-specific vocabulary did you use?
Do your transitional words/phrases connect your sentences smoothly?

Anticipatory Set:

Read the notes below on an imaginary chicken. Use a topic sentence, linking words, and a closing sentence to combine these notes into a well-organized paragraph.

Oznam Chicken Eggs:

-pink or purple
-about 10 eggs per week
-very soft shells
-medium size, cube shaped eggs

Activity/Investigation:

1. After sharing and discussing Anticipatory Set responses…Tell students that today they will use their notes from last session to write a short report about their breed of chicken. Tell students that this report along with a poster (to be created later) will be displayed at school. Ask students to take out and review their notes.

2. Tell students the organizational structure they will use: Introduction paragraph, body paragraphs with facts and details, and closing paragraph. Students may use paragraph headings if they like. Tell students that they will also need to include a paragraph that explains why we have chickens at Manzo and how they are connected to other ecology systems we have at school. Write a phrase bank on the board that includes linking phrases and words (for example, additionally, because, etc.). Remind students to use domain-specific vocabulary from their research and from the chicken diagram poster (hang this up) in their report. Decide whether you want students to do collaborative writing with their partner or write individually.

3. Give students most of the rest of the class period to develop their reports.

During a separate class period, students should edit their work and write a final draft suitable for publishing in a public spot at school.

Closure:

Quickly divide the class into 2 different groups by counting off group 1 and group 2. (Students will remain at their seats for now.) Group 1 will underline or highlight a sentence that uses domain specific vocabulary. Group 2 will underline or highlight a sentence that uses a transitional word or phrase. Tell students that they will take turns reading the paragraph that their sentence contains (so that there is context to the sentence) aloud to their partner. Students will ask for feedback on their use of linking phrases or domain-specific words from their partners. Have students show their group number on their fingers and partner up with a classmate with a different number to do this activity.

After a few minutes of sharing, students return to their seats. Ask a few students to share their sentences and for the class to evaluate their use of linking words and domain-specific vocabulary.

Teacher Reflection:

Chickens

Lesson 3 ~ Classifying and Plotting Eggs by Weight

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4. MD.4**. Make a line plot to display a data set of measurements in fractions of a unit (1/2, ¼, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots. **4. NBT.5**. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.
Ecology Objective:	•Students will recognize how different types of chickens lay eggs of different colors, sizes, and frequencies.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •Why would someone want a diverse flock of chickens? **Culture** refers to the language, values, and beliefs that people use to perceive and interact with their surroundings: The biodiversity and climate of a region are interconnected with the region's culture. •How do domesticated animals fit in our culture?
Content Objective: ***Math*** *Reading* *Writing* *Other:*	•Students will create line plots of egg weights in increments of 1/8 ounces
Language Objective:	

Vocabulary	**Materials**
Radius, diameter, circumference, area, volume, pi, multiplicative, formula, irrational number	•1 week's worth of chicken eggs sorted by the breed that laid them (Do this by separating eggs by color/size. If you do not know which breed lays which eggs, you will need to temporarily separate the mystery chickens individually (dog crate works well for this) to determine the quality of their specific eggs. •Poster paper •Egg weight sample poster

Seasonality: This lesson/unit would work during any season, as it is not reliant on any natural phenomenon.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions:				

Note: This lesson may take 2 class sessions—one to do computations and calculations in a journals and one to organize information into a poster.

Anticipatory Set:

Organize this data into a line plot.

Length of worms in worm bin (inches):

¾	1 ½	3 ¾	2	3 ¾	4 ½	2 ¼

•What is the difference in length of the shortest and longest worm?

Activity/Investigation:

1. After discussing Anticipatory Set responses *and connecting this activity to work 4th graders did in 3rd grade in terms of measuring and using line plots to the nearest ¼ of an inch…* Tell students that today they will be creating a poster that summarizes some weights of eggs from their specific breed of chicken, including a line plot. Show students the eggs that you have sorted by breed of chicken. Tell students that what they see represents the number of eggs laid in one week (or whatever increment of time you choose.) Sorting these eggs out will definitely require some planning!

2. Show students the model poster (see accompanying documents). Ask students to share how the poster is organized. Point out the chart that shows how eggs are classified or graded by their size. Ask students if they have noticed this on eggs they have purchased from the grocery store. Show students a couple egg cartons that have the grade of the eggs labeled on them. Tell students that they will gather into groups by breed of chicken they are studying. Once in groups, each student will take turns weighing and classifying an egg using a digital scale at their groups and recording it in a data chart they will make in their journals. Tell students they must use care in weighing the fragile eggs.

2.5. Disregard this step if you are having students use an analogue scale that shows increments of 1/8s ounce (which is probably pretty unlikely). Show students the following chart:

Fraction to Decimal Equivalencies:	
1/8	
¼	
3/8	
½	
5/8	
¾	
7/8	
1	

Ask students to help you fill in the decimal equivalencies for halves and quarters as they should know this from third grade. Next, have them help you fill in the missing spaces for eighths. Give students the clue that the missing numbers will be exactly between the numbers above and below. (Since you can't go exactly between using hundredths, just round up). Post the completed chart (which should look like below) on the board.

Fraction to Decimal Equivalencies:	
1/8	0.13
¼	.25
3/8	0.38
½	0.5
5/8	0.63
¾	0.75
7/8	0.88
1	1.00

2.6. Tell students that the scale they use will list the weights in decimals, but they will record data and make a line plot using fractions. Give students a few examples to check for understanding. Make sure students can choose the right fractional equivalent by making sure that the equivalency is either equivalent or greater, but not greater than the next fraction larger. For example .67 would be 5/8 and .09 would be 0. This is important because the grading system of eggs must be greater than the benchmark weight, not rounded to the nearest benchmark weight.

3. Once all eggs have been weighed, tell students they will compile egg weights on a chart on the board separated by breed. Everyone will use this data to make a line plot of egg weights with X's color coded by breed of chicken.

4. Students will also calculate the average weight of an egg from their specific breed of chicken. Show students how to do this by adding up the individual eggs' weights, and dividing by the total number of eggs.

5. Students will also use multiplication to predict how many eggs might be laid in a year. Ask students what other information they will need to have to calculate this. (They will need to know the number of weeks in a year so they can multiply one week by 52.)

6. Tell students that their work in finding the average weight and number of eggs per year must be shown clearly and explicitly on their poster. Allow students to work first with their larger breed group to weigh and then to work on the computations and line plot in their journals with their research partner. Once you have checked their work they may transfer their work onto a poster paper.

Closure:

Distribute small scrap paper to students. Tell them they will need to look at their line plot to answer the following questions:

1. What is the difference/range between the weight of the heaviest and lightest egg?

2. What is a typical range of egg weights?
3. What outliers do you see?
4. What is the most common egg weight?

After students have had time to solve these individually, allow them to share responses with their partner. Then review answers with the whole class.

Post completed reports with accompanying posters in the classroom or hallways.

Teacher Reflection:

Chickens

Lesson 4 ~ Chicken Idioms

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**L.4.5.** Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
Ecology Objective:	•Understand the influence of chickens on our culture—specifically through language.
Enduring Understandings and Essential Questions	**Culture** refers to the language, values, and beliefs that people use to perceive and interact with their surroundings: The biodiversity and climate of a region are interconnected with the region's culture. •How have chickens influenced our culture?
Content Objective: *Math* ***Reading*** ***Writing*** *Other:*	•Students will recognize and explain the meaning of idioms
Language Objective:	

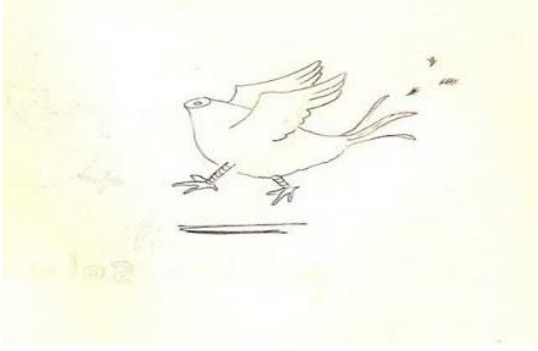
Vocabulary	**Materials**
Idiom, figurative language	•Chicken Idiom student worksheet •Chicken Idiom teacher key

Seasonality: This lesson/unit would work during any season, as it is not reliant on any natural phenomenon.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: How can you use the context of a sentence to figure out the meaning of an idiom?

Anticipatory Set: Look at the image below.



Can you think of what idiom (saying) this comic illustrates? Describe it! Now use that saying in a sentence of your own.

Activity/Investigation:

1. After discussing Anticipatory Set responses and reviewing correct responses and strategies… Tell students that today they will study some idioms that involve chickens. Take a moment to define idioms and give some non-chicken examples of idioms. Explain that an idiom is a saying that doesn't make literal sense. For example, *it's raining cats and dogs, piece of cake,* and *costs an arm and a leg* are all examples of commonly used idioms in English.

2. Tell students that today they will each get an idiom of their own. Each idiom involves chickens, as chickens have been an important domesticated animal throughout the world—so important that they have influenced our language. Their job is to read their idiom to 5 classmates, record their classmates' interpretation of the idiom, and then write their own interpretation of the idiom. Tell students that they will need to use context clues to interpret the meaning. Allow students time to do the activity by mingling with classmates. If students finish early, they should write a new sentence on the back of their paper using the idiom correctly in context.

3. After sufficient time has passed, ask students to return to their seats and write their own interpretations of the idiom on their paper. One by one ask each student to share their idiom with the class as well as their interpretation of it. Use the teacher key to determine if their interpretation was correct. Alternately, you could make a photocopy of the teacher key for each table to read and evaluate themselves.

Possible Extension: Students can use their chicken idiom (or a chicken idiom of their choice) to create a poster. Their poster should include a sentence of their own using the idiom correctly in context, an illustration of their sentence, and an interpretation of the idiom using literal language.

Closure:

Pose the following question to the class: How does the use of idioms affect the way we speak, listen to, read, and write language? Allow students to think, share with a partner and then share with the whole class.

Teacher Reflection:

UNIT 2: Measurement Unit

Unit Summary:
This is a four-lesson unit in which students will gain experience measuring a variety of objects using both metric and customary systems. Students will create 2-column charts showing conversions and equivalencies within each system of units. This unit of study will culminate with students creating posters that display their learning.

Lesson Summaries:

Lesson 1 ~ Introduction to Customary Units of Measurement
Teacher introduces unit of study to students and provides demonstrations and examples of how to use customary systems of measurement and the tools that correspond to each system. Students get a partner with whom they will collaborate throughout the unit. Together they choose 4 things in the courtyard they would like to measure using length, weight, time, and volume.

Lesson 2 ~ Measuring and Recording Using Customary Units
Students go to the courtyard with their partner to take and record their measurements of length, weight, time and volume of previously selected items in four ten-minute rotations.

Lesson 3 ~ Measuring and Recording Using Metric Unit
Teacher provides examples and demonstrations on how to use Metric systems of measurement and the tools that correspond to each system. Students will choose 3 things to measure in the courtyard using length, mass, and volume. Students will then go to the courtyard to take and record their measurements in three ten-minute rotations.

Lesson 4 ~ Displaying Measurement Results
Students will select one of their data sets of measurement to present on a poster. In addition to displaying their data, students will also designate a portion of their poster to summarize what they learned about measurement through this unit.

Measurement

Lesson 1 ~ Introduction to Customary Units of Measurement

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4. MD.1.** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),*
Ecology Objective:	
Content Objective: *Math Reading* *Writing* *Other:*	•Students will choose items from the courtyard that can be measured using length, weight, volume, and time. •Students will select the appropriate customary unit for each item.
Language Objective:	

Vocabulary	**Materials**
measure, metric, customary, convert/conversion, relative size, liquid volume, mass, length, distance, inch (in), foot (ft), yard (yd), mile (mi), ounce (oz), pound (lb), cup (c), pint (pt), quart (qt), gallon (gal), time, hour, minute, second, equivalent, operations, add, subtract, multiply, divide, fractions, decimals, area, perimeter	*Rulers, yardsticks, measuring tapes for length and distance *Stopwatches or clocks for time *Scales for weight *Measuring cups for volume *Portable conversion charts

Seasonality (If more specificity is required, please note date/time range under season)

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: What in the courtyard has length (or weight or volume or time)? What would be the best tool for measuring this?

How can you best organize your data?

Anticipatory Set:

a. Name a living or nonliving thing in our courtyard.
b. Now describe different ways you could **measure** it.
c. What **tools** would you use?
d. What **units** would you use?

Activity/Investigation:

1. Teacher provides direct instruction/review on customary/US Standard units of measurement including length/distance, weight, time, and volume. Emphasis should be given to weight and volume as these should be less familiar to fourth graders. Demonstrate how a scale can be used to measure both pounds and ounces for weight. Demonstrate how measuring cups can be used to measure volume. Show how you can use both the tool and the conversion chart to make conversions. Ask students to look for patterns they see in the conversion chart. Time and length were standards from third grade and should require only a brief review.

2. Teacher either distributes pre-made data tables for students to write directly on, or gives students time to create data tables in their journals. (See provided data table. I prefer having the kids recreate data tables in their notebook as it forces them to notice the organization of the table). Teacher provides instruction on how to use data tables in the courtyard, doing an example for the class.

3. Students get into work pairs. Together students will choose 4 things from the courtyard they would like to **measure**. (For example: **length**—width of greenhouse door, **time**—how many minutes it takes to empty a full watering can onto the garden, **weight**—how many ounces is a dozen eggs, **volume**—how many pints of soil are in a pot). It may be helpful to list possible examples on the board, especially for time. You may wish to give partnerships a few minutes in the courtyard to consider their options. Make sure that each type of measurement is big enough to convert to a smaller form of measurement. For example a student should pick an activity for time that will take at least 60 seconds so that it can be converted up to at least one minute. Students will also write in their **tables** what **tools** they will use for each.

4. Tell students that during the next class session, they will actually go to the courtyard to take and record their measurements.

Closure Question:

Describe something new you learned about customary/US standard measurement today.

Teacher Reflection:

Measurement

Lesson 2 ~ Measuring and Recording Using Customary Units

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4. MD.1.** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),*
Ecology Objective:	
Content Objective: *Math Reading* *Writing* *Other:*	•Students will measure objects accurately using an appropriate unit of **customary** measurement of their choice. •Within a single system of measurement, students will use a smaller unit and convert it to a larger unit of measurement. •Students will record data in a two-column table.
Language Objective:	

Vocabulary	**Materials**
measure, metric, customary, convert/conversion, relative size, liquid volume, mass, length, distance, inch (in), foot (ft), yard (yd), mile (mi), ounce (oz), pound (lb), cup (c), pint (pt), quart (qt), gallon (gal), time, hour, minute, second, equivalent, operations, add, subtract, multiply, divide, fractions, decimals, area, perimeter	*Rulers, yardsticks, measuring tapes for length and distance *Stopwatches or clocks for time *Scales for weight *Measuring cups for volume *Portable conversion charts

Seasonality (If more specificity is required, please note date/time range under season)

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: What patterns do you see in your conversion chart?
How are you and your partner maintaining precision as you measure?
How is each partner contributing to the thinking and measuring?
How can you convert from [smaller unit of measurement] to [larger unit of measurement]?

Anticipatory Set:

Use your conversion charts to answer both questions:	
a. It took the chickens 379 seconds to finish all the compost scraps leftover from lunch. How many minutes (or minutes *and* seconds) is this?	b. The small aquarium in the aquaponics system contains 38 cups of water. How many pints (or pints *and* cups) is this?
When you finish, locate your data table from last week, review it, and improve its neatness or organization if necessary.	

Activity/Investigation:

1. Teacher reminds students that today they will be working with their partner from last time to measure and record their pre-selected items in the courtyard. Tell students your procedures for their work outdoors. Students will work in a rotation of measuring length, time, volume, and weight for ten minutes each. Divide the class into sets of partnerships based on which system of measurement they will do first. For example, the partnerships that start with volume will do weight second, length third, and time last. Tell them that when they hear the whistle/bell/handclaps/etc. that means their ten minutes are up and they will return measuring tools to a designated outdoor station, exchange them for their new set of tools, and switch to the next unit of measurement. This will continue until all four rotations have been completed. Make sure that all students have their conversion charts, notebooks, pencils and appropriate tools before going outside.

2. Students go outside to begin their work. Teacher and/or assistant monitors students' progress and helps as needed. Teacher monitors time and signals for groups to rotate when necessary.

3. After all rotations are complete, teacher signals for students to clean up and return to class for closure.

4. Tell students that during the next class session, they will do a similar activity using metric systems of measurement.

Closure Question:

Pick a measurement system: length, time, weight or volume. Write numbered step by step instructions you use to convert from a smaller unit to a bigger unit. What happens if the smaller unit doesn't fit perfectly within the larger unit?

Teacher Reflection:

Measurement

Lesson 3 ~ Measuring and Recording Using Metric Units

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4.MD.1.** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),*
Ecology Objective:	
Content Objective: *Math Reading* *Writing* *Other:*	•Students will measure objects accurately using an appropriate unit of **metric** measurement of their choice. •Within a single system of measurement, students will use a smaller unit and convert it to a larger unit of measurement. •Students will record data in a two-column table.
Language Objective:	

Vocabulary	**Materials**
measure, metric, customary, convert/conversion, relative size, liquid volume, mass, length, distance, kilometer (km), meter (m), centimeter (cm), kilogram (kg), gram (g), liter (L), milliliter (mL), equivalent, operations, add, subtract, multiply, divide, fractions, decimals, area, perimeter	*Rulers, yardsticks, measuring tapes for length and distance *Scales for weight *Measuring cups or graduated cylinders for volume *Portable conversion charts

Seasonality (If more specificity is required, please note date/time range under season)

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: What would be the best tool for measuring the length (or weight, or volume, or time) of an item in the courtyard this?
How can you best organize your data?

Anticipatory Set: (First provide students with a new metric conversion chart)

You have had practice using a conversion chart for **customary** units of measurement. Now use your new metric conversion charts to answer both questions:	
a. One of our vegetable plots is 200 centimeters long. How many meters is this?	b. Each day, the chickens are fed 4,000 milliliters of chicken feed. How many liters is this?
Bonus: At another school, their chickens are fed 2,500 milliliters of food each day. How many liters of food is this?	

Activity/Investigation:

1. Teacher provides direct instruction about measurement using the metric system. Tell students that time is most typically measured only in the customary system, so they will not be practicing this again today. Show students a meter stick and how it contains both centimeters and meters. Show students how a scale and a balance can measure weight in grams or kilograms. Show students how a graduated cylinder can measure the volume of something using milliliters and liters. Demonstrate and provide examples of how to use the chart to make conversions just like we did with the customary systems of measurement.

2. Teacher either distributes pre-made data tables for students to write directly on, or gives students time to create data tables in their journals. (see provided data table). Teacher reminds students how to use data tables in the courtyard, doing an example for the class.

3. Teacher reminds students that today they will be working with their partner from last time to measure and record their pre-selected items in the courtyard. (You choose whether they measure the same objects as before or select different ones.) Tell students procedures for their work outdoors will be the same as last time. Students will work in a rotation of measuring length, volume, and weight, for ten minutes each. Divide the class into sets of partnerships based on which system of measurement they will do first. For example, the partnerships that start with volume will do weight second, length last. Tell them that when they hear the whistle/bell/handclaps/etc. that means their ten minutes are up and they will return measuring tools to a designated outdoor station, exchange them for their new set of tools, and switch to the next unit of measurement. This will continue until all three rotations have been completed. Make sure that all students have their conversion charts, notebooks, pencils and appropriate tools before going outside.

4. Students go outside to begin their work. Teacher and/or assistant monitors students' progress and helps as needed. Teacher monitors time and signals for groups to rotate when necessary.

5. After all rotations are complete, teacher signals for students to clean up and return to class for closure.

4. Tell students that during the next class session, they will compile their data and summarize their learning on a poster.

Closure Question:

Was it easier for you to make measurement conversions using the metric system like we did today or by using the customary system like we did last time? Use precise language to explain your choice.

Teacher Reflection:

Measurement

Lesson 4~ Displaying Measurement Results

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4. MD.1.** Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. *For example, know that 1 ft. is 12 times as long as 1 in. Express the length of a 4 ft. snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),*
Ecology Objective:	
Content Objective: *Math Reading* *Writing* *Other:*	•Students will record measurement equivalents in a two-column table •Students will write to explain their knowledge of relative sizes of measurement units.
Language Objective:	

Vocabulary	**Materials**
measure, metric, customary, convert/conversion, relative size, liquid volume, mass, length, distance, kilometer (km), meter (m), centimeter (cm), kilogram (kg), gram (g), liter (L), milliliter (mL), inch (in), foot (ft), yard (yd), mile (mi), ounce (oz), pound (lb), cup (c), pint (pt), quart (qt), gallon (gal), time, hour, minute, second, equivalent, operations, add, subtract, multiply, divide, fractions, decimals, area, perimeter	*Poster paper *Lined paper *Crayons, markers, and glue *Rulers, yardsticks, measuring tapes for length and distance *Scales for weight *Measuring cups or graduated cylinders for volume *Portable conversion charts

Seasonality (If more specificity is required, please note date/time range under season)

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: How can you make your poster easy to read?
How are you helping your partner to think about measurement?

Anticipatory Set: (First provide students with a new metric conversion chart)

Today you will be creating a poster. Describe some skills and techniques you would like to tell your partner so he/she understands how to make a poster neat, well organized, and easy to understand.

Activity/Investigation:

1. Teacher explains that today students will work with their same partner to create a poster that summarizes their learning about measurement over the last few class sessions. Teacher will provide a template that students can use or allow students to create their own design as long as it contains all the required elements.

2. Tell students that the purpose of a poster is to communicate information, usually in a way that attracts viewers to it because it is beautiful and well organized. Their posters must contain the following information:

-Title
-Names and Date
-Organizational features (color, lines, etc.)
-A 2-column table of one of their measurements from a previous session
-A 2-column table that shows the conversion pattern for the units selected above. This table should show between 5 and 10 different conversions.
-A paragraph summarizing their learning about measurement including the following:
-Tell what each measures: length, time, weight, volume. (Time measures how many seconds, minutes, or hours something takes to happen, etc.)
-Describe the patterns you see in the conversion table.
-Describe how you made your own conversions from a smaller unit to a larger one.

3. Students will each make their own poster. They should however, sit with their partner and think together, share ideas, and check each other's work.

Closure Activity: (Take about 10 minutes or more for this one)

Either hang posters or have students display them at their desks. Give each student a note card to write down observations about posters. Then do a gallery walk in which students view and read posters created by other students in silence. On their note cards students should finish the following sentence starters:

a. "I notice that…."
b. "A question I have for _____ is…"

Allow time for selected students to read a statement or question from their note cards to facilitate discussion.

Teacher Reflection:

Unit 3: Lizard Unit

Recommendation: Since this unit uses advanced grade-level math skills, it is recommended that this unit be taught toward the end of the school year.

Unit Summary
(With minor changes, this unit could be easily adapted as a 5th grade unit.) Students learn about common lizards in Tucson and then perform a capture and release experiment, which will allow them to estimate the number of lizards in two separate areas of school.

Lesson Summaries:

Lesson 1 ~ Researching Commonly Found Lizards in Tucson
Students will research basic facts about common urban lizards in Tucson and make a poster sharing their findings about an assigned or chosen type of lizard.

Lesson 2 ~ Population Estimation Simulation
Students will do an investigation involving beans that simulates the Lincoln Index Method of capture, mark, and release to estimate a population size.

Lesson 3 ~ Setting up the Population Estimation Experiment
Students will create pooters/aspirators out of vinyl tubing to catch prey (ants or other small insects) for potentially captured lizards. Students will create and place live lizard traps and place them in the tortoise habitat and another selected area of the school.

Lesson 4 ~ Setting up the Population Estimation (cont'd)
Continuation of Lesson 3

Lesson 5 ~ Using Data to Estimate Populations
Students will check live traps, mark any lizards found as part of sample 1, and then release them. A day or so later, students will return live traps to original locations. After time has passed, students will record data of how many and what type of lizard was captured as part of sample 2. Students will calculate an estimated population and graph results.

Lesson 6 ~ Presenting and Summarizing the Investigation
Students will describe their results of the investigation as conclusions to the experiment. Students will focus their conclusions on comparing how the elements of each habitat affected the number of lizards found in each one.

Lizards

Lesson 1~ Researching Commonly Found Lizards in Tucson

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4. W.6:** Conduct short research projects that build knowledge through investigation of different aspects of a topic. **AZ Science 4.4.4.1:** Recognize that successful characteristics of populations are inherited traits that are favorable in a particular environment.
Ecology Objective:	Gain understanding for and respect about Sonoran Desert Lizards found in urban areas of Tucson
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •How does increased/decreased biodiversity affect life on earth? •How can humans create biodiverse spaces?
Content Objective: *Math Reading* ***Writing*** *Other:* ***Science***	•Students will conduct a short research project about pre-determined categories, and summarize their learning in an organized paragraph.
Language Objective:	

Vocabulary	**Materials**
Range, habitat, diet, specie, life cycle, adaptations, physical appearance	•Literature about common lizards found in Tucson (resources TBA) •Poster paper •Student notebooks

Seasonality This lesson will work better during warm weather when lizards and their prey (insects) are active. While autumn and spring are shown below, the activities will be more successful if done toward the beginning of autumn or the end of spring to capitalize on warm weather.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Connections to: Climate Culture Energy/Materials Health

Guiding Questions: What category does your fact best fit into?
What text features are you using to help you find the answers to your questions?
Using your own language, what's the most important thing you learned about _____ aspect of your lizard?

Anticipatory Set:

Make a KWL Chart about the wild lizards found in Tucson, stating what you already know about lizards, what you'd like to know, and what you've learned. (Leave the "L" portion blank for now since we haven't had our lesson about lizards yet!)

Know	What I'd like to Know	Learned

Activity/Investigation:

1. After reviewing student responses…Tell students they are about to embark on a unit in which they read and learn about lizards, make a poster about their findings, and perform some investigations involving lizards found in the tortoise habitat. Tell students that today, they will specifically be researching an individual specie of lizard and displaying their findings with a paragraph and drawing on a poster. Then, show students the reading materials available to them. Have students designate a portion of their journals to transcribe the categories (adaptations, diet, habitat, life cycle, physical appearance, range) they will be researching about the lizards.

2. Give instruction on how to use organizational features in the texts to help them find desired information.

3. Give instruction on how to effectively take notes. Tell students what plagiarism is and that this is not our goal here! Model effective note-taking skills. Place a text under the document camera and begin by showing the students the table of contents. Ask students which page number is likely to directly relate to either a question they have or a topic on their notes page. Go to that page, read it aloud. After reading a paragraph, shut the book and show students how you write in your own words a summary of the most important fact/facts you just read and use organization to add them to the appropriate portion of your notes. Tell students the book should only be opened to check spelling. If you have students do research on a computer, you can model how you briefly turn off the monitor while you write your summary and then turn it back on to continue researching.

4. Assign (or allow students to choose) a lizard to each student to research (there will be much overlapping of lizard species). You may wish to group students by type of lizard and have them work with a pair within the group. You may wish to lead a guided reading group with struggling readers. Consider assigning struggling readers the same type of lizard so a guided reading group can be more easily facilitated. Lizards most commonly found at Manzo are:

1. Sceloperous magister…..Desert Spiny Lizard
2. Calisaurus draconioides…..Zebra tailed Lizard
3. Urosaurus ornatus……Ornate tree Lizard
4. Uta stansburianna….Western Side-blotched Lizard
5. Aspidoscelis tigris….Tiger Whiptail
6. Aspidoscelis sonorae…Sonoran Whiptail

7. Phrynosoma solare…..Regal Horned Lizard

5. Before students begin research, have them begin by writing the name of each book in their journal on a page titled "Sources." Have students highlight each book/source name in a different color. As students write notes, have them highlight their notes in the color that matches the book title. Tell students this will get them used to citing their sources and allow them to reference a source if needed by matching colors of notes to book titles. Students begin their research and note taking. Remind them to work with purpose so they write information about each of the six research categories so they can make an informative poster.

6. Students will create posters (draw a template on the board) to display their learning. Their poster must include the lizard's name, a paragraph with topic sentence, supporting details, and closing sentence, and a color drawing of the lizard.

Closure Question:

Have students take turns sharing their posters with members of their table group. Rather than having students read their whole paragraphs aloud, instead ask students to share the most interesting adaptation their lizard has.

Teacher Reflection:

Lizards

Lesson 2~ Population Estimation Simulation

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4. NBT.5**. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **4. NBT.6**. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **5.Extended Common Core Standards in Measurement and Data:** 4. Organize and represent data using bar graphs. 5. Title and label axis of graph. 6. Answer questions posed about the collected data.
Ecology Objective:	•Students will perform an investigation allowing them to estimate a simulated population of organisms.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •How does increased/decreased biodiversity affect life on earth? •How can humans create biodiverse spaces?
Content Objective: ***Math*** *Reading* *Writing* *Other:*	•Students will use a formula involving multiplication and division to estimate an imaginary population. •Students will graph results of experiment on a coordinate plane and interpret results.
Language Objective:	

Vocabulary	**Materials**
Specie, population, community, habitat, estimation, formula, trial, sample	•a bag or 2 of light colored beans of the same variety •a bag (or less) of a different colored bean of the same size as original bean (black eyed peas and black beans might work well) •Three small containers per group

Seasonality This lesson will work better during warm weather when lizards and their prey (insects) are active. While autumn and spring are shown below, the activities will be more successful if done toward the beginning of autumn or the end of spring to capitalize on warm weather.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*

July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: What are some of the challenges in counting the lizards in the wild?
How could one estimate the number of organisms in a certain place?
How can we make sure to respect the lizards as we study them?
How is this simulation similar to/different from marking-releasing-re-catching lizards in the wild?
Does the Lincoln Index produce more accurate results when more animals are caught, marked and released, or when fewer animals are caught, marked and released?

Anticipatory Set:

Let's say a scientist wants to know what species and how many of each species of lizard live in the Desert Biome. Make a list of challenges that would make this task difficult or even impossible.

Activity/Investigation: (This investigation will almost certainly require 2 class sessions—one to perform the experiment an one to calculate estimates, graph results, and interpret results. This is a modified version of 2 different experiments posted online from the Nuffield Foundation and by Michael J. Gregory, Ph.D.)

1. After reviewing student responses…Tell students that today they will perform an experiment. Tell them this is relevant because once we do this simulation, next time we will be doing it with real lizards.

2. Tell students they will simulate population estimation using a mark-release-recapture method called the Lincoln Index. This is a method invented by a scientist. (Please see attached document, specifically beginning on page 7). Discuss situations when it is appropriate to count (when it is small enough or still enough; for example, a population of mesquite trees in a park) a total population and when it's best to estimate (when it's too large, if the population moves around a lot or is hiding).

3. Tell students they will work with a group to perform this experiment.

Each group will get a container with 500 (keep this number secret!) black beans and a white out pen to mark their captured beans. (alternately, instead of marking the beans with whiteout, they could be replaced with black eyed peas—however this method is not as direct of a simulation and could make it more difficult for children to make the connection between this simulation and actually capturing, marking, and releasing a real animal).

Demonstrate the experiment through step f.

a. Have students copy the following chart from the board into their journals:

Trial	Capture Sample, S1	Second Sample, S2	Recaptured (previously marked), R	Population Estimate, P
1	10	10		
2	25	25		
3	50	50		
4	100	100		
5	200	200		

b. Remove 10 beans. This is the first capture sample.

c. Mark each of these black beans with white out. Wait for the white out to dry completely.

d. Replace marked black beans into the population in the container. Mix thoroughly.

e. Remove a second sample of 10 black beans at random (put your hand in the container and remove them without looking at them). You may or may not recapture some marked beans in this sample. Record this number in your table.

f. Replace the marked beans in the container.

g. Replace 15 more unmarked beans (black beans) with marked beans (black eyed peas) and mix them in. (You now have 25 marked beans [or black eyed peas] mixed into the total population of 500)

h. Remove another second sample, this time of 25 beans.

i. Record the number of recaptured marked beans.

j. Continue to complete the table by adding new marked beans and removing samples for sample sizes of 50, 100 and 200, (while maintaining a total population size of 500). You may wish to skip 200 if time does not permit.

k. Now count and record the number of beans, so that you know the true population size (make sure kids actually get **500**). At the same time, separate the marked and unmarked beans, so they can be used again.

l. Calculate the population estimates for each of your samples.

m. Calculate the population estimates to complete your table. Plot a graph of population estimate against sample size. Add a horizontal line to show the true population, to see how sample size can affect the validity of the population estimate.

n. If time permits, repeat some of the sample sizes and plot the new results on your graph.

4. See page 8 of attached document from the Nuffield Foundation for a full explanation of using the formula and why it works. Explain this to students and use the formula to demonstrate how to fill in the last 2 columns of the first row in the chart they've copied.

Example:

Formula: P = (S1 x S2)/R

Trial	Capture Sample, S1	Second Sample, S2	Recaptured (previously marked), R	Population Estimate, P	Difference from Actual (x - 500)
1	10	10	1	= (10x10)/1 = **100**	-400
2	25	25	1	= (25x25)/1 = **625**	+125
3	50	50	6	= (50x50)/6 = **416.67**	-83.33
4	100	100	19	= (100x100)/19 = **526.32**	+26.32
5	200	200	-	-	-

Once students have completed the experiment, it might be a good breaking point so that students can finish computation necessary for completing the last two columns of the chart below during the next session, at which time they will also graph and interpret results. Consider doing the next steps during another class session:

5. Students will use the first quadrant of a coordinate plane to graph their results on graph paper as coordinate pairs. Y axis is Population estimate. X axis is capture population size.

6. Students will then write conclusions that interpret their results. Conclusions should touch on:
   - -What is this graph about?
   - -What does the graph tell you?
   - -Which sample size is closest to the actual population? Which sample size is furthest from the actual population?
   - -What does this tell you about using the Lincoln Index to estimate population sizes?

7. Teacher asks each group which sample size produced the most accurate results. Teacher records this on the board.

Closure Question:

Direct students' attention to the chart you just made in step 7. What does this information tell you about using the Lincoln Index to estimate population size? How can we use this knowledge to guide our investigation to estimate the population of real lizards?

Teacher Reflection:

Lizard Unit

Lesson 3~ Setting up the Population Estimation Experiment

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**AZ Science Standard: 4.1.2.1:** *Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.* **AZ Science Standard: 4.1.2.2**: Plan a simple investigation that identifies the variables to be controlled. **AZ Science Standard: 4.1.2.3**: Conduct controlled investigations (e.g., related to erosion, plant life cycles, weather, magnetism) in life, physical, and Earth and space sciences.
Ecology Objective:	•Students respect lizards and their habitat while conducting an investigation.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •How does increased/decreased biodiversity affect life on earth? •How can humans create biodiverse spaces?
Content Objective: *Math Reading* *Writing* *Other:*	•Students will set up an investigation that does not harm lizards or damage their habitat. •Students will describe which variables are being controlled in the experiment.
Language Objective:	

Vocabulary	**Materials**
Specie, population, community, habitat, estimation, formula, trial, sample, variable, pooter/aspirator, live trap	To make live traps: •Enough plastic soda or water bottles so each pair of students has one bottle •Sharp scissors •Tape To make pooters/asipirators: -Window screen or ribbon with a loose weave -2 feet of vinyl tubing with inner diameter of approximately ¼ inch per group of 2 students -2 or three inches of vinyl tubing with outer diameter to match that of tubing above for each student •Enough rope to rope off a space with an area equivalent to that of the tortoise habitat
Seasonality This lesson will work better during warm weather when lizards and their prey (insects)	

are active. While autumn and spring are shown below, the activities will be more successful if done toward the beginning of autumn or the end of spring to capitalize on warm weather.

Monsoon July-Sept.	*Autumn* Oct.-Nov.	*Winter* Dec- Feb.	*Spring* Mar.-Apr.	*Dry Summer* May-June

Guiding Questions: For the best accuracy in our population estimate, is it best to catch a small or large number of lizards?
How can we conduct this experiment in a way that respects the lizards and their habitat?
What are some things that might go wrong in this experiment? How can we do our best to prevent these problems?

Anticipatory Set:

You have already learned some information about lizards from your research a few classes ago. Today we will create live traps for lizards. Based on what you know about lizards, what might work best to lure lizards into our traps? What other considerations should we take as we make and set up our traps?

Activity/Investigation:

1. After reviewing student responses…Tell students that today they will create live traps for lizards and aspirators for catching lizard bait (insects, especially ants). Then they will set up their experiments outside.

2. Tell students that one measure of the health of an ecosystem or habitat is the biodiversity within it. Tell students that today we will prepare an investigation that will help us estimate the number and diversity of lizards we have in both our tortoise habitat and one other area of the school. Later we will compare the data from both areas and see what we notice.

3. Put students into working pairs. Show them how they will make the live trap, then allow them time to make one themselves. (Consider variables when students make their traps—all bottles should be the same size or there should be the same variety of bottle sizes for both areas of study—the tortoise habitat as well as whatever area students also choose to study) This video shows how to make the trap:
http://www.youtube.com/watch?v=IHfsTnOFeFg
Pay special attention to the trap's entrance. Either scuff up the plastic, or tape a paper towel in it or coat it with a mixture of paint and sand or paint and dirt that lizard claws won't just slip off of. Make sure that the edge where the two pieces connect is completely sealed with tape so ants will not escape. Additionally, place some weights, such as small stones or dirt, in each trap so that traps stay in place and don't blow away. Lastly label each trap with the name of the location it will be to prevent confusion later.

3. Once students have finished creating traps show them how to make pooters/aspirators. (This might be a good short activity to do before this class session and have students catch ants on their own time at recess or other structured break.) To make an aspirator:

-Take an approximately 2-foot length of vinyl tubing that's about ¼ inch inner diameter

-Place a small piece of ribbon with an open weave or window screen over on end of the tubing.

-Take a 2 or 3 inch piece of slightly larger tubing that fits snugly over the outside of the first vinyl tube. Take this smaller length of tubing and place it over the longer piece of tubing with the screen or ribbon blocking the path between them. The two tubes need to overlap only enough so that they do not easily detach. Each pair of students will get one long piece of tubing, one piece of screen/ribbon and 2 shorter lengths of vinyl tubing. This way each pair has one aspirator but each student will have their own interchangeable piece of shorter tubing upon which to put their mouths.

4. To catch ants, find an area with ants and get your aspirator. The long end of the tube goes toward the ants, the short end in your mouth. Simply suck up the ant and blow it into a temporary lidded container! (The screen prevents you from accidentally ingesting ants.) Students should go outside to collect a predetermined number of ants so that each trap has an equal amount of ants.

5. Once ants are captured and traps are made, set them on a counter away from students so that the class can have a discussion about setting up the experiment. Make sure the discussion includes safety (of students and lizards), variables (make sure that students control every variable as much as possible including size of habitat areas, amounts of ants in each trap, number of traps set in each habitat, etc.)

6. Ask students, "Besides the tortoise habitat, where is another area of the school you would like to catch lizards? This way we can compare diversity and number of lizards in 2 different areas of the school. Once students have reached consensus on another area of the school, ask them, what variables about each area of the school should we make sure to control. (Area, number of traps, amount of ants in each trap, etc.) Once decision has been made, tell students that we will continue setting up our experiment next class session. Before that, have students use their journals to write their hypothesis about which area will have the greatest number and diversity of lizards.

Closure Question:

Describe some of the most important safety measures we put into place for our experiment.

Teacher Reflection:

Lizard Unit

Lesson 4~ Setting up the Population Estimation Experiment (Cont.)

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**AZ Science Standard: 4.1.2.1:** *Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, organisms) in all science inquiry.* **AZ Science Standard: 4.1.2.2**: Plan a simple investigation that identifies the variables to be controlled. **AZ Science Standard: 4.1.2.3**: Conduct controlled investigations (e.g., related to erosion, plant life cycles, weather, magnetism) in life, physical, and Earth and space sciences.
Ecology Objective:	•Students respect lizards and their habitat while conducting an investigation.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •How does increased/decreased biodiversity affect life on earth? •How can humans create biodiverse spaces?
Content Objective: *Math Reading* *Writing* *Other:*	•Students will set up an investigation that does not harm lizards or damage their habitat. •Students will describe which variables are being controlled in the experiment.
Language Objective:	

Vocabulary	**Materials**
Specie, population, community, habitat, estimation, formula, trial, sample, variable, pooter/apirator, live trap	•Lesson 4-Quick Write (see accompanying documents) •Lesson 4-Tortoise Habitat Diagram (see accompanying documents) •Baited live traps from last class session •Enough rope to rope off a space with an area equivalent to that of the tortoise habitat •Tent Stakes •Tape Measure

Seasonality This lesson will work better during warm weather when lizards and their prey (insects) are active. While autumn and spring are shown below, the activities will be more successful if done toward the beginning of autumn or the end of spring to capitalize on warm weather.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: For the best accuracy in our population estimate, is it best to catch a small or large number of lizards?
How can we conduct this experiment in a way that respects the lizards and their habitat?
What are some things that might go wrong in this experiment? How can we do our best to prevent these problems?
What variables will we need to control?

Anticipatory Set:
Find the area of this irregular shape by decomposing it into rectangles. (Give each student a copy of "Lesson 4-Quick Write.)

Activity/Investigation: (*This investigation is a direct continuation of lesson 3.)*

1. After reviewing student responses… Ask students what we will need to know about the tortoise habitat in order to select our other site (its area). Distribute to each partnership a copy of "Desert Tortoise Habitat Diagram." Ask students to use their knowledge multiplication, arrays, and how to find a shape's area to break down the tortoise habitat into shapes that the area can be easily determined using a formula (squares or rectangles). Inside each rectangle, students should write the equation (length times width = area) they used to determine the area. Once they can no longer break up the space into squares and rectangles, they will need to count or estimate the remaining area of the irregularly shaped leftover parts of the habitat. All areas should then be added to find the total area of the habitat.

2. Now have students work with their partner to compute dimensions of rectangles that would have the same (or very close) area as the tortoise habitat.

3. Once a new set of dimensions has been determined and agreed upon, have the class go outside with the rope and tape measure to the other site selected for lizard study. Use tent stakes or large nails to stake rope to the ground using the predetermined dimensions.

4. Place live traps in both locations (remember to control variables!). Also, place signage explaining your experiment at each site so that well-meaning people don't recycle all your plastic bottles!

5. Decide with your class a designated amount of time you will leave traps out for the first catch and release as well as the second catch and release. Make sure not to leave traps out over the weekend when lizards might be trapped for an overly long time and die.

Closure Question:
Describe some of the variables we made sure to control in our experiment. Why is it important for scientists to control variables in an experiment?

Teacher Reflection:

Lizards

Lesson 5~ Using Data to Estimate Populations

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**4.NBT.5**. Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **4.NBT.6**. Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **5.G.2**. Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.
Ecology Objective:	•Students will perform an investigation allowing them to estimate the population of lizards in two areas of the school.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •How does increased/decreased biodiversity affect life on earth? •How can humans create biodiverse spaces?
Content Objective: *Math Reading* *Writing* *Other:*	•Students will use a formula involving multiplication and division to estimate an imaginary population. •Students will graph results of experiment on a coordinate plane and interpret results.
Language Objective:	

Vocabulary	**Materials**
Specie, population, community, habitat, estimation, formula, trial, sample, variable, pooter/apirator, live trap	•Baited live traps from last class session •Enough rope to rope off a space with an area equivalent to that of the tortoise habitat

Seasonality This lesson will work better during warm weather when lizards and their prey (insects) are active. While autumn and spring are shown below, the activities will be more successful if done toward the beginning of autumn or the end of spring to capitalize on warm weather.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: Did the results match your hypothesis?
If we were to do this experiment again, how could we improve upon it?

Was there anything surprising about the results?

Anticipatory Set:

Look back at your notes from when we used the Lincoln Index to estimate imaginary bean populations. In your own words, summarize:

a. how the Lincoln Index works

b. what mathematical steps you use to estimate a population

Activity/Investigation: (*This lesson will take place during 2 or 3 separate days—one day to mark and release lizards from the first sample, and one day to record data and estimate population sizes. The first day or two of catch, mark, release, and reset traps should take up far less time than an entire class period.)*

1. Use the same procedures outlined in Lesson 2 using beans to do this lesson. Begin by collecting all live traps with lizards in them (making sure to keep the traps from the 2 separate areas separate). Mark the back of each lizard with a small dab of non-toxic paint. Release lizards back to the habitats from which they came. Allow them sufficient time to intermingle (like mixing up the beans in Lesson 2). Perhaps do this at the beginning of the school day and put traps back in the same locations as before. Alternatively, mark and release the lizards one day and then replace live traps the next day.

2. Once live traps have been set out for the same amount of time as for the first sample, collect traps with lizards in them, record data, (number and species of lizards) and release lizards to their found location.

3. Using the same formula referenced in Lesson 2, students should calculate the estimated population of lizards.

4. Students will then make a bar graph showing the number and variety of lizards captured in each area.

5. Intermittent closure: Ask students, "Why do you suppose the results came out the way they did? For what reasons are there more lizards in _____ than in _____? Students should get up and talk to other classmates about their suppositions. Then ask a few students to share their ideas with the class.

6. Lastly, students will write their interpretations of their data and their conclusions of their results. Ask students to focus on the elements of each of the two habitats selected as part of their interpretations.

Closure Question:

What's the most interesting thing you learned throughout our experiment involving lizards?

Teacher Reflection:

Lizards

Lesson 6~ Presenting and Summarizing the Investigation

Teacher: Grade Level: 4 Date:
Author: Wes Oswald

Common Core Standard:	**AZ Science Standard 4.4.4.1:** Communicate verbally or in writing the results of an inquiry. (See W04-S3C3-01) **AZ Science Standard 4.4.4.3**. Communicate with other groups or individuals to compare the results of a common investigation.
Ecology Objective:	•Students will represent the results of an ecological investigation with an emphasis on the effects of a habitat on the number and diversity of lizard species it holds.
Enduring Understandings and Essential Questions	**Biodiversity** (the variety of life on Earth): All ecosystems contain a variety of organisms that are interdependent. •How does increased/decreased biodiversity affect life on earth? •How can humans create biodiverse spaces?
Content Objective: *Math Reading* *Writing* *Other:*	•Students will communicate the results of their scientific investigation on a poster through writing, graphs, and pictures.
Language Objective:	

Vocabulary	**Materials**
Question, Hypothesis, Methods, Data Table, Graph, Conclusions	•Poster papers •Art Materials.

Seasonality This lesson will work better during warm weather when lizards and their prey (insects) are active. While autumn and spring are shown below, the activities will be more successful if done toward the beginning of autumn or the end of spring to capitalize on warm weather.

Monsoon	*Autumn*	*Winter*	*Spring*	*Dry Summer*
July-Sept.	Oct.-Nov.	Dec- Feb.	Mar.-Apr.	May-June

Guiding Questions: Did the results match your hypothesis?
If we were to do this experiment again, how could we improve upon it?
Was there anything surprising about the results?
How was the quality of our data? Do you think we captured enough lizards to have a reasonable estimate of population size?

Anticipatory Set: (Display a previously made science poster board. If you don't have one, ask Wes Oswald to loan you one!)

Study this Science Poster.

a. Describe what makes this poster look visually appealing and organized.
b. Describe improvements you would make to this poster.

Activity/Investigation:

1. After reviewing responses from the Anticipatory Set… Tell students that today they will show the results of their investigation on a science poster. Show a few more examples from the internet or real life of student-created science posters. Discuss how each poster has a question, research, hypothesis, methods, data tables, graphs, conclusions and pictures, or some variation thereof. Write a list of all necessary parts on the board for students to reference. Additionally lead a discussion about what makes a poster look organized and visually appealing.

2. Next, students will get back with their work partner. Then tell students that they have most of this information already created. Their question, hypothesis, data tables, and graphs are already complete. They can use some of their graph interpretations from lesson 5 as a basis for their conclusions. Tell students that an important area you'd like them to focus on for their conclusions is how the quality of a habitat affects the quantity and diversity of the lizards. Note that in addition to interpreting data and graphs, scientific conclusions typically tell why their findings matter, what they learned from the experiment, what they would do differently if they were to redo their experiment, and whether or not their hypothesis was correct.

3. Students then create posters. This activity could lend itself to one more class period in which students spend half of the class period finishing their posters and the last half summarizing their findings to the whole class or to small groups.

Closure Question:

Have students spend some time viewing and reading the posters of other students in the class. Then ask students to share specific compliments for posters they think are especially well done.

Teacher Reflection:

Appendix 1~ Chicken Unit Supplemental Materials

Egg Weight Poster Example

(Name of Chicken Breeds') Eggs

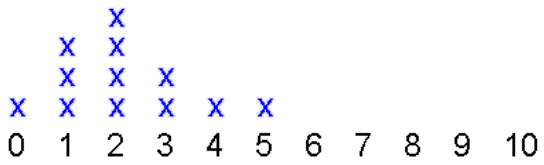
Modern Sizes (USA)

Size	Mass per egg
Jumbo	Greater than 2.5 oz. or 71 g
Extra-Large (XL)	Greater than 2.25 oz. or 64 g
Large (L)	Greater than 2 oz. or 57 g
Medium (M)	Greater than 1.75 oz. or 50 g
Small (S)	Greater than 1.5 oz. or 43 g
Peewee	Greater than 1.25 oz. or 35 g

Data Chart

Egg Number:	Weight:	Grade of Egg:
1	2 oz	Med.
2	2 1/8 oz	Large
3	2 oz	Med.
4	1 7/8 oz.	Med.
5	2 1/8 oz.	Large

Line Plot

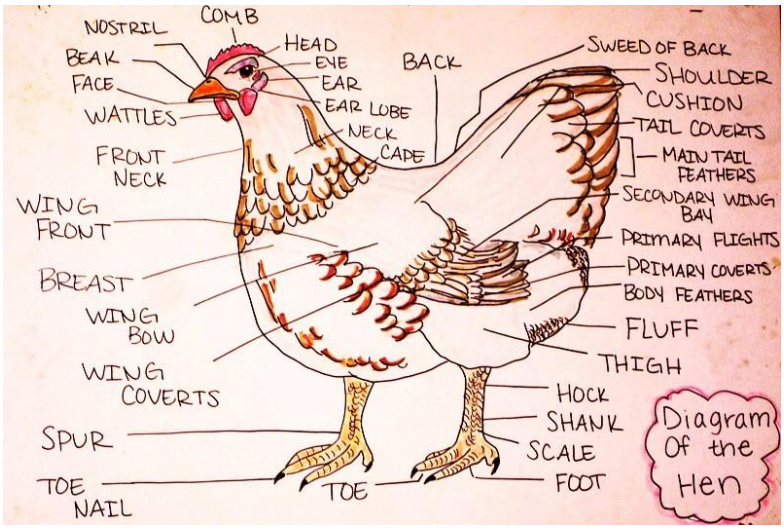


Average Weight of an Egg

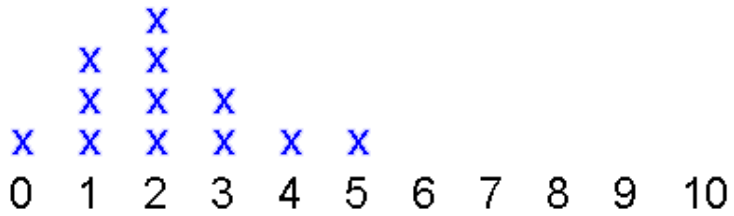
If Rate of Egg Laying Continues, How Many Eggs would be laid per year?

Summary:

Sample Chicken Diagram



Line Plot Example



Chicken Idioms – Teacher Key

I do not know if I should buy a new computer so I can make some money with it or make some money first and then buy a new computer. It is a **chicken and egg situation**. *(a situation where you can't tell the cause and effect relationship or which comes first)*
The amount of money that I spent last night was **chicken feed** and I am not worried about it at all. *(a small amount)*
My friend was planning to come with us but he **chickened out** at the last moment. *(afraid)*
Don`t count your chickens before they`re hatched. Remember, you may not get the new job so you should not spend too much money. *(Don't rely on something that hasn't happened yet.)*
My grandfather always **goes to bed with the chickens** because he works on a farm. *(Goes to bed early)*
I do not know how old my aunt is but she is **no spring chicken**. *(old)*
The two boys were **playing chicken** in the schoolyard. *(A dangerous game designed to test the nerve of the players involved)*

Patricia is putting her entire savings into starting up a restaurant. I'm worried she's putting **all her eggs in one basket.** *(Placing all of one's hopes/money/security into one thing)*
My parents have been **feathering their nest** so that when they're retired they don't have to worry about money. *(Putting away savings money on a regular basis)*
Stop being such a **mother hen**. I can do this myself! *(An overprotective person)*
Jeremy went to visit his family in Texas, but they must have **flown the coop.** *(Left)*
Rick cries so easily if I say the wrong thing. It's always like **walking on eggshells** around him. *(to be overly careful with a person or situation)*
I've got so much work to do - I've been **running around like chicken with its head cut off** all week. *(Acting without direction or acting in a chaotic state)*
"**Shake a tail feather**," Mom snapped. "We're going to be late!" *(Hurry up)*
When the boy said that he thought that the moon was made out of green cheese his friends called him a **birdbrain**. (A stupid person)
The interviewer **ruffled the president's feathers** when she asked the same question again after he'd tried to avoid answering it. *(To annoy or disturb someone)*
Fred's in hospital with liver problems. I guess **the chickens have come home to roost** after all those years of heavy drinking. *(*You have to face the consequences of your mistakes or bad deeds)
Stan had **egg on his face** after saying he could easily do fifty push-ups, and then giving up after doing just twenty. *(To be caught lying or doing something embarrassing)*
Watch out for Virginia. She really **rules the roost** around here. *(To be the boss)*
Javier feels really low in the **pecking order** at work since he just started a few days ago. *(Social hierarchy or order)*
Please don't **brood over** Albert. He's no good for you. *(To worry or be depressed about something)*
Dude, I can't read your **chicken scratch**! What does this say?? *(Messy or illegible handwriting)*
"Don't hang around Alex," warned Tiffany. "He's really a **bad egg**." *(Dishonest person or one with low moral standards)*
After all their kids had gone to college or moved out, Mr. and Mrs. Rodriguez felt the **empty nest syndrome.** *(lonely feeling parents have when kids have moved out of the house)*
I told Mr. Amos that finding a phone booth downtown would be like finding **hen's teeth**. *(a rare or impossible occurrence)*

Template for Chicken Idiom Exercise (Lesson 4)

Name:

Chicken Idioms

Read this sentence with a chicken idiom in it to at least 5 classmates. Take turns asking what they think the idiom means. Write down their responses.

I don't know if I should buy a new computer so I can make some money with it or make some money first and then buy a new computer. It is a **chicken and egg situation**. (use this template for the other idioms,too)
My friends think it means: • • • • •

Draw a star next to what you think is the best interpretation

I think it means:

Here's what it really means:

Appendix 2~Measurement Unit Supplemental Materials

Conversion Tables

Conventional

Length		Time		Weight		Volume	
12 inches (in.)	1 foot	60 seconds (sec.)	1 minute (min.)	16 ounces (oz.)	1 pound (lb.)	2 cups (c.)	1 pint (pt)
3 feet	1 yard	60 minutes (min.)	1 hour (hr.)	2,000 pounds (lbs.)	1 ton (t)	2 pints (pt)	1 quart (qt.)
5,280 feet	1 mile	24 hours (hrs.)	1 day	4 quarts (qts.)	1 gallon (gal.)		
		7 days	1 week				
		12 months (mo.)	1 year				
		52 weeks	1 year				
		100 years	1 century				

Metric

Length		Weight		Volume	
100 centimeters (cm)	1 meter (m)	1,000 grams (g)	1 kilogram (kg)	1,000 milliliters (ml)	1 liter (l)
1,000 meters (m)	1 kilometer (km)				

Data Tables

Customary Units

Length	
Item I'm measuring	
Units	
Inches	Feet

Time	
Item I'm measuring	
Units	
Seconds	Minutes

Weight	
Item I'm measuring	
Units	
Ounces	Pounds

Volume	
Item I'm measuring	
Units	
Milliliter	Liter

Metric Units

Length	
Item I'm measuring	
Units	
Centimeters	Meters

Weight	
Item I'm measuring	
Units	
Grams	Kilograms

Volume	
Item I'm measuring	
Units	
Smaller appropriate unit	Larger appropriate unit

Sample Poster Template

Title

Conversion table for (inches) and (feet)

Inches	**Feet**
12	1
24	2
36	3
48	4
60	5
72	6

Conversion table for the _____ I measured

Inches	**Feet**
45	3 feet and 9 inches

Summary:

Length measures….
Time measures…
Weight measures…
Volume measures…
I see some patterns in the conversion table….
To convert _____ to _____ you…
Metric and Customary units are similar because…
Metric and Customary units are different because…

Appendix 3~ Lizard Unit Supplemental Materials

For the Nuffield Foundation Guide to the Lincoln Index Method, see page 7 of:
http://www.nuffieldfoundation.org/sites/default/files/20_Distrib_abund_spc.pdf

Aspirator

Live Trap

Desert Tortoise Habitat Diagram

Manzo's Desert Tortoise Habitat