AMPHITHEATER ELEMENTARY SCIENCE CURRICULUM

6/30/2015

Second Grade

The following pages provide guidance to teachers when implementing science instruction in Amphitheater Elementary Schools. This guide will be revised regularly to ensure alignment with current Arizona State Standards and the requirements of the district.

FORWARD

Dear Teachers and Administrators,

One of the best ways to engage children in their learning and in the world around them is to provide hands-on opportunities to learn and actually "do" science. Science and engineering education is more important than ever. Becoming college and career ready not only involves gaining factual knowledge, it also involves teaching children to question, explore, build, collaborate, explain, analyze, think critically and creatively, and communicate. Science provides the opportunity for all children to be engaged and solve problems which require these skills.

Over the past two years we have implemented new curriculum in the areas of reading and mathematics. Both of these curriculum areas are critical to student success. Science skills and processes give students real situations to apply what they have learned in reading, writing, and mathematics. Technical writing is necessary when students record their observations, record their analysis of data, and develop conclusions and reports. Integration of the subject areas is critical.

A committee of district teachers met over the past six months to discuss science in our schools, review the Arizona Science Standards, make recommendations regarding the teaching of science, discuss the need for materials, and to develop a science curriculum framework for our schools. According to the committee's analysis, science instruction is scarce in most elementary classrooms, if taught at all. There are classrooms where science is taught regularly. This was a pleasant finding. **The committee is recommending that science be taught a minimum of 90 minutes per week for all students beginning with the 2015-2016 school year.**

A common question is, "How will we fit this in?", or, "What should we give up?" in order to teach science. *You will be given the flexibility to reduce some of the time spent on reading and/or math in order to teach science.* Many creative scheduling ideas have come up when teachers begin to talk about how to fit the teaching of science into the day/week.

We introduce the **Amphitheater Elementary Science Curriculum** guides. These guides lay out the Arizona Science Standards by grade level, list important academic vocabulary in science, give suggestions for materials and resources and provide many other details for teachers as they prepare their science instruction. We added engineering standards to our curriculum because we know that this type of thinking and "doing" is an important part of STEM education. Inquiry and the Engineering Design Process are the two main threads from Kindergarten through fifth grade. The new curriculum guides will be available electronically and in print. Each school will be scheduling a time to review and discuss the guides, allocate time and resources toward science, and to inventory their science materials.

The guides are not all inclusive. There are many more resources in the community that are not listed, and many more materials that are very effective and practical. We hope to add to these as teachers contribute what they use in their classrooms.

Thank you for all you do to teach science to our youngest scientists!

Sincerely,

Dr. Roseanne Lopez, Chief Academic Officer Elementary Education

Amphitheater Elementary Science Curriculum Plan	
Grade: K-2	**Strand: 1 Inquiry Process (Science Lab)**

Enduring Understandings (Big Idea)

Inquiry uses the scientific process to conduct a complete investigation which is embedded into all areas of science.

Essential Questions

What is the process for conducting an investigation?
What evidence should be in a science journal during a complete investigation?
How do we use scientific investigations to find answers to questions?

Understanding the Content of this Standard	Essential Knowledge, Skills, and Processes
1. Identify a problem.	• Make **observations** using multiple senses • Ask questions about a simple problem • Collect **research/**information • **Predict** the **results** in a **hypothesis** (using "if-then" language)
2. Scientific testing	• Demonstrate safe behavior and appropriate procedures • Find and list materials and tools • With guidance list the complete steps to conduct the **investigation** • Participate in the **investigation** • Make **observations** and measurements • Record **data** in a **data chart** (chart, table, list, log)
3. Analyze data and draw conclusions	• Organize the data into **graphs** (bar, pictograph, tally chart) • **Interpret** the results of the data • **Compare** the results to the **hypothesis** • Generate **questions** for possible future **investigations**
4. Communication	<u>Explain the results</u> • Create a display of the complete **investigation** • Include a science journal with all parts of the **inquiry process** including **research**, testing, and **analysis** • Present the results with others (classroom, grade level, Science Fair)

Science Vocabulary	
inquiry, question, scientific process, experiment, investigation, opinion, hypothesis, observations, data chart, graphs, results, compare, communication, research, predict, data, models, patterns, conclusion, evidence, classify, sequence, label, diagram, etc.	
Assessment	
Research report Science Fair projects (individual, group, or class) Interpretation and evaluation of data and graphs to answer the relevant question Science journal showing reflections throughout the inquiry process Presentation of the complete inquiry process Teacher observation	
Materials	**Resources and Ideas**
Research materials specific to each design	Research sites for kids: • www.factmonster.com • www.kidsclick.org • www.ipl.org/div/kidspace • www.kidrex.org www.sciencebuddies.org/ www.sarsef.org/ *(volunteers are available through SARSEF)* www.powershow.com/view/26bf93-Mzg0N/LPS_Science_Fair_Bill_Nye_the_Science_Guy_powerpoint_ppt_presentation FOSS kits Engineering is Elementary units Teachers Pay Teachers BrainPop

Amphitheater Elementary Science Curriculum Plan	
Grade: 2	**Strand: 4 Life Sciences**

Enduring Understandings (Big Idea)

Living things are made of systems which interact to sustain life.
All living things have a life cycle.

Essential Questions

-What are the major parts of the digestive, respiratory, and circulatory systems?
-How do the systems interact?
-How do living things grow and change?

Understanding the Knowledge and Content of this Standard	Essential Skills and Processes
The major parts of the digestive system are- mouth, esophagus, stomach, small and large intestines.	**Create** a model of each of the three body systems.
The major parts of the respiratory system are – nose, trachea, lungs, diaphragm.	**Compare and contrast** specific **life cycles**.
The major parts of the circulatory system are - **heart**, **arteries**, **veins**, **blood**.	**Identify** parts of digestive, respiratory, and **circulatory systems**.
The digestive system breaks down and absorbs food and gives nutrition to the body and disposes of waste.	**Describe** the functions of the digestive, respiratory, and circulatory systems.
The respiratory system brings oxygen to the body and exchanges it for carbon dioxide.	**Draw conclusions** about how body systems interact.
The **circulatory system** transports nutrients and oxygen throughout the body.	**Identify** animal structures that serve different functions.
Insects have a life cycle that has complete or incomplete **metamorphosis**.	**Investigate** the functions of different animal structures (eyes, feet, defenses, movement) and their adaptations.
Complete metamorphosis **stages** are: egg, larva, pupa, adult (examples: butterfly, ladybugs).	**Create** a model of a life cycle (complete or incomplete metamorphosis).
Incomplete metamorphosis stages are- egg, nymph, adult (examples: milkweed bug, dragonfly, and cockroach).	**Describe** the life cycles of various insects, mammals, and other organisms.
Mammal babies look like their parents.	**Make and record observations** on insect growth and change.
Life cycles of specific organisms can have similar or different stages.	Participate in science experiments on life cycles where they **question, predict, observe, record, experiment,**

	test, conclude, communicate results, and/or **compare** results.
Animal structures serve different functions (sensory, defense, locomotion).	Participate in science experiments on body systems where they **question, predict, observe, record, experiment, test, conclude, communicate results,** and/or **compare** results.
Science Vocabulary	
<u>Human Body/Animals</u> Mouth Esophagus Stomach Small intestine Large intestine Nose Trachea Lungs Diaphragm Heart Arteries Veins Blood Circulate Digest Inhale Exhale Exchange Transport Breakdown Oxygen Carbon Dioxide Nutrients Waste System Digestive Respiratory Circulatory Absorb Sensory Defense Locomotion/ Movement Function Structures Adaptation	<u>Life Cycles</u> Insect Mammal Metamorphosis Complete Incomplete Cocoon (moth) Chrysalis (butterfly) Pupa Egg Larva Adult Juvenile Cycle Head Thorax Abdomen

Assessment	
Design a new creature and **describe** its life cycle based on its classification (insect or mammal).	Body system parts sort
Project based assessment throughout experiments	Label parts of a life cycle on a diagram Label parts of body systems on diagram
Materials and Resources	
United Streaming videos: • Animal Life Cycles • Animal Groups – Beginning Classification Interactive Smartboard activities : Animal Life Cycles **http://preview.tinyurl.com/animlifcy** Animal Adaptations – Form and Function **http://tinyurl.com/anadapt** United Streaming video - Animal Features and Their Functions Discovery Education BrainPop Life Cycles Web quest - http://zunal.com/teacherspage.php?w=108677 Order Manduca eggs and food**:** http://tinyurl.com/carolinasupply The Manduca Project at www.manducaproject.com What Do You Do With a Tail Like This? by Steve Jenkins and Robin Page Animal Adaptations by Lisa L. Behm	**Books:** **Digestive System** Darlene R. Stille **The Respiratory System (True Book Series)** Darlene R. Stille **The Circulatory System (True Book Series)** Darlene R. Stille, Linda Cornwell, Ronald W. Schwizer Build a Body Human Body Science Activities DisneyNature: Wings of Life (Pollination, bees, hummingbirds, butterflies) DisneyNature: Born In China (2016) Website for Manduca Project: http://manducaproject.com Ideas for measuring Manducas: http://insected.arizona.edu/manduca/act_math/ideas.html Link to growth graph: http://insected.arizona.edu/manduca/PDFs/Act_Growth_Chart.pdf link to buy 1 gram cubes; http://www.sciencestuff.com/prod/L-SW/1105
Botanical Gardens field trip Sabino Canyon field trip International Wildlife Museum field trip	Slim Goodbody videos/ field trip

Amphitheater Elementary Science Curriculum Plan	
Grade: 2	**Strand: 5-Physical Science, 6-Earth and Space Science**

Enduring Understandings (Big Idea)

Weather patterns, temperature, and clouds are interdependent and create climate.
Everything is matter, and matter has different forms and change states.

Essential Questions

-How do we measure properties of matter?
- How do we measure conditions of weather?
-What is the relationship between clouds, temperature, and weather patterns?
-How and why does matter change between states?
-What are the three main types of clouds?

Understanding the Content of this Standard	Essential Skills and Processes
There are three main types of clouds- cumulus, cirrus, and stratus.	**Identify** and describe the three types of clouds.
Weather conditions like temperature and precipitation can be measured using appropriate tools and recorded.	Participate in science experiments on weather where they **question, predict, observe, record, experiment, test, conclude, communicate results,** and/or **compare** results.
Clouds and temperature determine weather patterns.	Participate in science experiments on matter where they **question, predict, observe, record, experiment, test, conclude, communicate results,** and/or **compare** results.
Water exists as a solid, liquid, or a gas.	**Analyze** the relationship between clouds, temperature, and weather patterns.
Materials can be classified as solids, liquids, or gasses.	**Apply concepts** learned to **design** an experiment on matter.
Solids have a definite shape.	**Compare** and **classify** objects based on properties of matter.
Liquids and gasses take the shape of their containers.	Use appropriate tools to **measure** and **record** the weather.

Science Vocabulary

<u>Weather</u> Precipitation, Temperature, Thermometer, Cumulus, Cirrus, Stratus, Anemometer, Wind vane, Rain gauge, Calendar	<u>Matter</u> Condense, Boil, Melt, Water vapor, Steam, Ice, Solid, Liquid, Gas, Evaporate

Assessment	
• Project-based assessment throughout experiments • Paper/pencil assessment on concepts • Teacher observation • Student journals	
Materials and Resources	
Smart Exchange lessons on matter and weather	Video clips on weather types
Web Sites: Solid, Liquid or Gas? States of Matter Changing States of Matter	**Web Sites:** Clouds Weather Jeopardy Weather **Books:** Cool Ali Cloudy With a Chance of Meatballs Bringing the Rain to Kapiti Plains Henry and Mudge and the Wild Wind Take home books: Hurricane and It's raining A-Z books: Earth's Water The Cloud Book by Tomie de Paola Weather Watch from MacMillan Air and Weather Foss kit Down Comes the Rain by Franklyn M. Branley

Amphitheater Elementary Science Curriculum Plan	
Grade: K-5	**Engineering Design Process**

Enduring Understandings (Big Ideas)

- Defining and Delimiting Engineering Problems
- Developing Possible Solutions
- Optimizing the Design Solution

Essential Questions

How might we define a simple design problem reflecting a need or a want?

What are the constraints/criteria?

How might we generate and compare possible solutions to a problem?

How might we plan and carry out fair tests?

How might we improve upon our design?

Understanding the Content of this Standard	Essential Skills and Processes
Students will be able to use the **Design Process.** *(italics denote K-2 language)*	**Design Process:** Students will understand how technology solves problems and makes work easier. Identify the problem (*Ask)* Do research Develop possible solutions *(Imagine)* Choose one solution Design and construct a prototype *(Plan and Create)* Test the prototype *(Test)* Evaluate and redesign *(Improve)* Communicate results
Identify the problem (*Ask)* ***Research*** Find a design problem, based on the fact that peoples' needs and desires change over time as well as their demand for new technologies.	• Identify & create a solvable **design problem/need/want** • Explain why that problem is relevant • Conduct research

Create or identify criteria for success and constraints.	• Understand & explain that there are **constraints** on **material**, **time** and **costs**
Develop possible solutions *(Imagine)* Generate and compare possible solutions to a problem.	• Work within the criteria while **generating** possible **solutions** • Judge solutions against constraints • Identify solution(s) that best fits problem
Design and construct a prototype *(Plan and Create)* Plan the model or prototype based on chosen solution(s). Create the model prototype.	• Design a **model**. • Communicate the design of a model (written on paper, whiteboard, or computer software, etc.) • Construct a model using available resources.
Test the prototype *(Test)* Design and conduct fair tests with controlled variables.	• Plan and conduct **fair tests** using **prototypes** • **Control variables** • Consider **failure points** found through testing
Evaluate and redesign *(Improve)* Evaluate & redesign model.	• Use failure points to identify parts of a model that can be improved • Make changes to the model (**redesign**). • Repeat testing process
Communicate results Communicate results.	• Explain your results using data • Gather input from peers • Describe successes and failures • Suggest improvements based on the criteria and failure points
History of Engineering and Innovation	
How have individuals contributed to engineering innovations?	• Research the various contributions of scientists and innovators in this field (e.g., Wilber and Orville Wright, Leonardo da Vinci, Thomas Edison, Benjamin Franklin, Steve Jobs, Bill Gates, Mary Anderson-windshield wiper, George de Mestral-velcro, Alan Turing-computer science/cryptologist, Hedy Lamarr- basis for wi-fi). • Describe how science, engineering and technology have improved the lives of people. • Critique the benefits and risks related to the use of technology. • Investigate careers related to engineering & design.
Science Vocabulary	
prototype, model, design, process, predict, evaluate, technology, record, research, create, problem, solution, design problem, want, need, individual, community, global, technology, criteria, constraints, materials, cost, generate, compare, options, reasonable, plan, blueprints, investigate, variable, fair test, control, failure points, redesign	

<table>
<tr><td colspan="2"></td></tr>
<tr><td colspan="2">Assessment</td></tr>
<tr><td>Formative</td><td>Summative</td></tr>
<tr><td>Reflections
Center activities (teacher observation)
Engineering Journals</td><td>Performance assessment
Presentation of design</td></tr>
<tr><td>Materials</td><td>Resources</td></tr>
<tr><td>Engineering is Elementary Units
Various materials for making models and prototypes</td><td>Discovery Education
Reading Street Leveled Readers (on-line)
Reading A-Z leveled readers
Khan Academy
http://www.sciencekids.co.nz/engineering.html
www.teachengineering.org
http://www.childrensengineering.org/
http://www.childrensengineering.com/freeresources.htm
https://www.teachengineering.org/googlesearch_results.php
http://betterlesson.com/lesson/620237/the-wonderful-towers-of-watts-building-background-knowledge?grade=14&subject=2&from=bl_directory_no-keywords_second-grade_technology-and-engineering_mt-lesson_620237_title
http://www.engr.ncsu.edu/theengineeringplace/educators/k8plans.php
https://drive.google.com/folderview?id=0Bzm8D1yH2vdZXzlERWhDYTFFLXc&usp=sharing
YouTube videos
Nasa For Kids: Intro to Engineering
The Engineering Process: Crash Course Kid
National Science Foundation Resources: https://www.nsf.gov/news/classroom/engineering.jsp
Teachers Pay Teachers</td></tr>
</table>