Applying Evidence-Based Instructional Strategies

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Intended Learning Outcomes For This Class

Intended Learning Outcomes

Students in this course will be able to

		IRA Standards	UETS Standards
1 -	Critically evaluate the application utility of current research on reading and writing processes for selecting appropriate instructional practices	1.1	6,7
2 -	Apply to professional practice evidence-based instructional strategies that address the needs of all K-12 readers and writers	1.2,1.3	6,7
3 -	Develop and be prepared to implement a curriculum to meet the needs of specific readers and writers, especially those who struggle with reading and writing	2.1,2.2,5.3	1,2

Science and Literacy

- Procedural Writing
- Group Discussion
- Vocabulary
- Reading Strategies
- SEEd Strategies
  - 3-Dimensional Science
  - Working with a Phenomenon

6th Grade: Teach with Three Dimensional Science In Mind

- TEACHING THE NEW 6TH GRADE SCIENCE SEED CORE USING THREE DIMENSIONS OF SCIENCE
  - Scientific and Engineering Practices (SEP)
  - Crosscutting Concepts (CCC)
  - Disciplinary Core Ideas (DCI) Science

Teaching should engage students in performances of science at the intersection of these three dimensions.

6th Grade: Teach with Three Dimensional Science In Mind

Disciplinary Core Ideas

1. Earth and Space Science
2. Life Science
3. Physical Science
4. Engineering

6th Grade: Teach with Three Dimensional Science In Mind

Scientific and Engineering Practices

1. Asking questions and defining problems
2. Developing models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (science) and designing solutions (engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

6th Grade: Teach with Three Dimensional Science In Mind

Crosscutting Concepts

1. Patterns
2. Cause and Effect
3. Scale, proportion, and quantity
4. Systems and system models
5. Matter and energy
6. Structure and Function
7. Stability and change

Three Dimensions of Science

- Science education includes these three dimensions of science understanding:
  - science and engineering practices
  - crosscutting concepts
  - disciplinary core ideas.
- Every standard includes each of the three dimensions
  - **Science and Engineering Practices are bolded.**
  - Crosscutting Concepts are underlined.
  - Disciplinary Core Ideas are in normal font.
  - *Standards with specific engineering expectations are italicized.*

Three Dimensions of Science--Example

Standard 6.2.4

Design *an object, tool, or process* that minimizes or maximizes heat energy transfer. *Identify criteria and constraints, develop a prototype for iterative testing, analyze data from testing, and propose modifications for optimizing the* ***design solution***. Emphasize demonstrating how the structure of differing materials allows them to function as either conductors or insulators.

TEACHING The SCIENCE CORE USING THE CURIOSITY OF PHENOMENA

- Humans are born with innate curiosity.
- They explore their environment and seek to know more without any help from anyone.
- Curiosity is an emotion that fuels science learning.
- Curiosity is related to inquisitive thinking, exploration, investigation, and learning.
- Curiosity is one of the significant human motivations for scientific investigations as well as for inquiries to discover knowledge.
- Since the early times humans have sought explanations for natural phenomena.
- Fortunately, our world (and universe) is full of intriguing things to wonder about.

TEACHING The SCIENCE CORE USING THE CURIOSITY OF PHENOMENA

- Curiosity is the aspect of learning which is going to lead to student investigation and wonder.
- Students will learn best by investigating phenomena to make sense of their world.
- When student learn science in this fashion, it will last a lifetime because they own what they have discovered themselves.
- There is much joy from investigating science phenomena.

TEACHING The SCIENCE CORE USING THE CURIOSITY OF PHENOMENA

- 1. Curiosity of a Phenomenon
  - Observe
  - Ask Questions
  - Wonder
- 2. Interest
  - Seek information and data
- 3. Reasoning
  - Use reasoning to construct explanations based on evidence

How Do I Make an Activity Happen For A Science Investigation?

- Start out with a phenomenon.
- Gathering
  - Research the phenomenon.
  - Using crosscutting concepts and science and engineering practices, students will plan and carry out an investigation (e.g. experiment) that will help show and help explain the phenomenon.
  - Gather materials, Know the Variables, Written Data
- Reasoning
  - Make a model with a written explanation of how the phenomenon happened.
  - Make real world connections with the experiment.
- Communication
  - Share what was found out using the evidence found in the experiment.

Three Dimensions of Science--Example

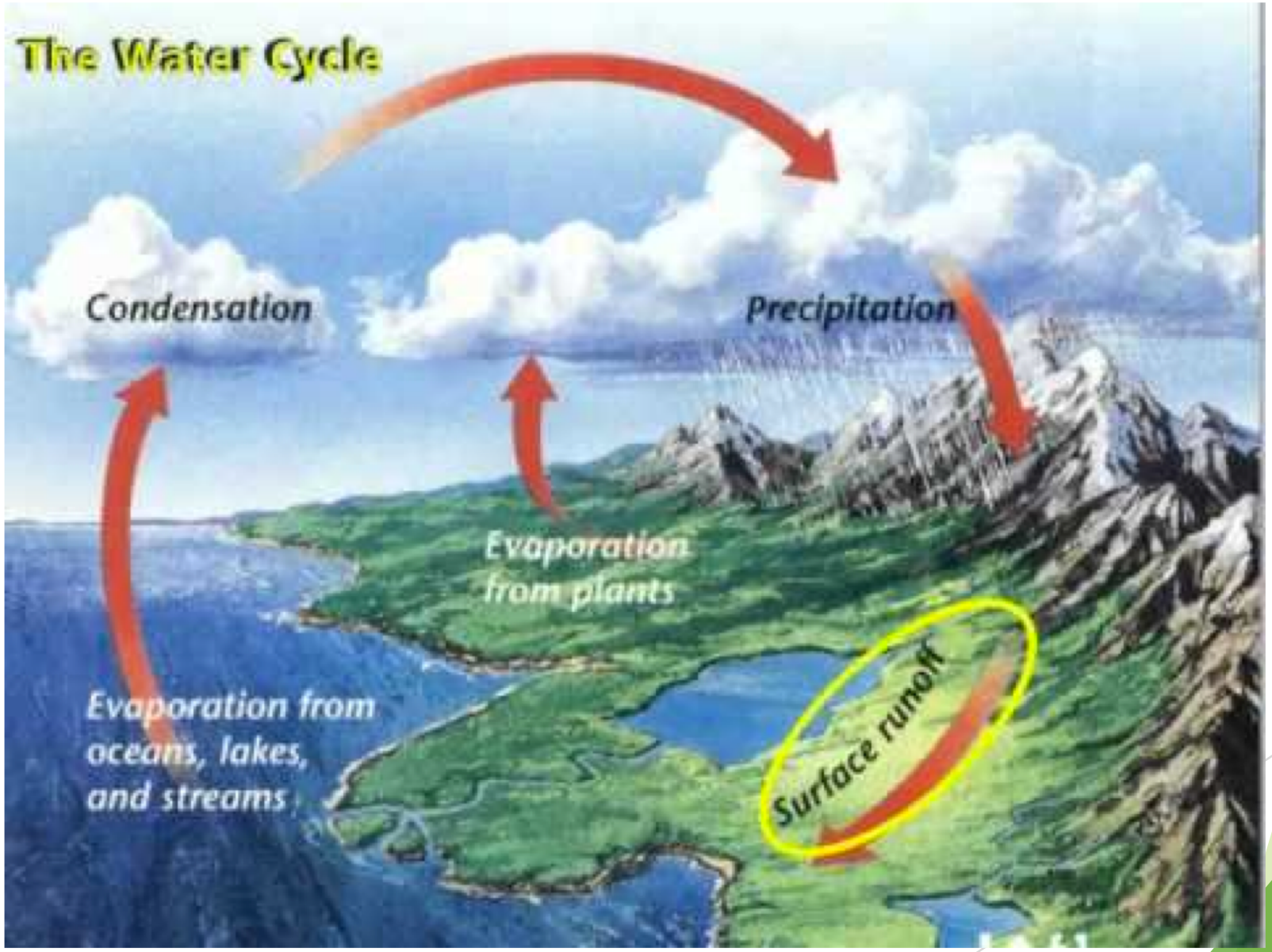
Standard 6.3.1

Develop a model to describe how the cycling of water through Earth's systems is driven by energy from the Sun, gravitational forces, and density.

Standard 6.3.2

Investigate the interactions between air masses that cause changes in weather condition. Collect and analyze data to provide evidence of how air masses flow from regions of high pressure to low pressure causing change in the weather. Examples of data collection field observations, laboratory experiments, weather maps, or diagrams.

Water Cycle Example



A Phenomenon Experiment: Making a Cloud

- Clouds are a phenomenon. Not very many people really know what causes clouds to form.
- Questions:
  - Why are the skies sometimes completely clear?
  - Why does the sky fill up with clouds?
  - Why are the skies sometimes partly cloudy?
  - Why do clouds come and go?
  - Lesson Plan: http://elemscience.jordandistrict.org/files/6.3.2.1a-Making-a-Cloud-in-a-Bottle.pdf

Cloud in a Bottle Directions

- Get into groups of three. One student pumps, one student holds the rubber stopper on the bottle, and one student shines the flashlight.
- Put on your goggles.
- Put a cup of very warm water into your two-liter bottle.
- Put some talc powder into the 2-liter bottle.
- One student puts the rubber stopper on the bottle opening and holds on to it tightly on the bottle.
- One student pumps about 30 pumps into the bottle.
- When 30 pumps have been put into the bottle, the student holding the rubber stopper deliberately pulls off the rubber stopper. There should be a small explosion of air coming from the escaping air.
- When done, the student holding the flashlight shines the light inside the bottle to see what happened in the bottle.
- Do this so everyone has a turn to pump, hold the rubber stopper, and shine the light.

Research These Areas to Explain How a Cloud Forms

- Individually or in pairs, research these different areas, writing your what you found out in your journals. (These are not necessarily in order.)
  - The Water Cycle of how energy transfers when water evaporates and condenses.
  - Air pressure
  - High pressure
  - Low pressure
  - High pressure meets a low pressure
  - Changing air pressure from high to low
  - Cold fronts
  - Warm fronts
  - How clouds form
  - Forming of Rain

Research With Videos

- How do Clouds Form?
- https://www.youtube.com/watch?v=CFKOw50dDZY

- The Making of a Cloud
- https://www.youtube.com/watch?v=UZEETyzql0Q

- How to Predict the Weather with Clouds
- https://www.youtube.com/watch?v=I00vcHLJXCc

- Weather Basics: Pressure and Fronts
- https://www.youtube.com/watch?v=E-5rieCUPuc

- Air Fronts
- https://www.youtube.com/watch?v=PJ4M6sERLM4

- Cold Fronts and Warm Fronts
- https://www.youtube.com/watch?v=huKYKykjcm0

- Fronts Animations
- https://www.youtube.com/watch?v=fdSWC5hYI0U

- How is rain formed? How clouds are formed? Why clouds are white?
- https://www.youtube.com/watch?v=ukZilXnSj6c

- How to Read Weather Maps
- https://www.youtube.com/watch?v=bd7DcVnrSL8

- Weather 101: How Clouds Form
- https://www.youtube.com/watch?v=loDkam4-q6E

- Weather 101: What are Fronts?
- https://www.youtube.com/watch?v=K1FZp_akfxo

- Creating a Weather Front
- https://www.youtube.com/watch?v=9U0W3-pruuY

Make a Model of the Water Cycle

- Make a model of the water cycle on the chart given.
- Discuss as a group your thinking of what is happening at the arrows of the the water cycle.
- Write your group's explanation of the science that is happening at the arrows.
- Be prepared to tell why the water cycles changes at each of the arrows.

Explain the Water Cycle with Use of Energy and/or Cause and Effect at Each Part of the Experiment

1. The heating of the water.
2. The water vapor.
3. Dust in the air.
4. High pressure change in the bottle.
5. Low pressure change in the bottle.
6. The forming of the cloud.

Components of the Literacy That Happened

- Reading Strategies
- Procedural Writing
- Group Discussion
- Vocabulary

Components of the Science That Happened

- A Phenomenon
- Developing a Model
- An investigation (experiment)
- Science of Energy
- Science of a Model
- Weather Vocabulary
- Gathering
- Reasoning
- Communication

Managing Groups During Lab Work

- Practice group work before doing science
- Keep groups small (2-4) is best
- Assign each group member a job
- One member should be the leader
- Give specific and detailed instructions
- Model as much as possible
- Forecast and plan for “glitches”
- Use graphic organizers
- Always have enough time for clean-up
- Always stress safety

Rules During Lab Work

- Follow the directions
- Don’t work ahead
- Everyone stays on task
- No talking within the group about other things
- No group member bothers a member of another group
- No goofing around
- Work on a timely basis--keep things going
- Students assigned to a certain task are the ones
  who do that task
- Keep it safe all the time--no exceptions

Journaling Ideas

Have students use a journal as much as possible when doing experiments.

- Use of journal during an experiment:
  - Writing down measurable data
  - Explaining what they saw happen
  - Making a graph
  - Explaining their thoughts on why it happened
  - Writing a conclusion