Designing Effective Science Instruction

Presented by: Anne Tweed

May 22, 2012
Identifying Learning Goals and the Criteria for Success Using the Next Generation Science Standards
Changing the Odds
for Student Success: What Matters Most

Anne Tweed
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What matters most?
Develop data-driven, "high-reliability" systems

Create high-performance school cultures

Provide whole-child student supports

Guarantee challenging, engaging, & intentional instruction

Ensure curricular pathways to success

What Matters Most
Research & guidance that focuses on what makes the most difference for students
WHAT MATTERS MOST

Research & guidance that focuses on what makes the most difference for students

- Develop data-driven, “high-reliability” systems
- Create high-performance school cultures
- Provide whole-child student supports
- Guarantee challenging, engaging, & intentional instruction
- Ensure curricular pathways to success
Guarantee challenging, engaging, & intentional instruction

The touchstones

- Content: Setting high expectations and delivering challenging instruction
- Understanding: Intentionally matching instructional strategies to learning goals
- Environment: Fostering engaging learning environments and meaningful relationships with students
Designing Effective Science Instruction

Content Understanding Environment
Content

Goal: Become clear about the key concepts (learning goals) you want the student to learn and how you will know they have learned them.
Understanding

Goal: Develop a learner-centered classroom so that students have opportunities to make sense of the content.
**Environment**

**Goal:** Consciously and deliberately create a culture in your classroom that values learning for all students.
Let’s Pause for Questions.
Identifying Important Content

1. Identify “big ideas,” key concepts (learning goals), knowledge and skills that describe what the students will understand.

2. Prune extraneous sub-topics, technical vocabulary and wasteful repetition.

3. Create essential questions that engage students with the content.

4. Identify common preconceptions and prior knowledge.

5. Develop assessments that correlate to the conceptual understanding and related knowledge and skills.

6. Clarify and sequence the learning activities to focus instruction on conceptual understanding.
What will be gained by mapping the curriculum to the NGSS?

• All teachers, especially those new to a district and/or the profession, will know what content and skills to teach, when to teach the information, and at what depth of knowledge

• Students across the nation/region/state will have equal access to the same content

• Each administrator will have access to information about what should be occurring in classrooms
Curriculum Frameworks Should Include…

**Essential Content** is learning that endures over time. Concepts, generalizations, principles, skills and processes that are essential for students to thrive in the 21st century.

When making the decision about what is essential content ask the question,

“How will students need to know and be able to do to thrive in the 21st century?”

Developing a Guaranteed and Viable Curriculum: A Fieldbook (McREL, 2007 unpublished)
Viable curriculum includes…

– *Opportunity* for students to learn the content.

– Adequate *time* for teachers to teach the content.

– Overall, ensuring that the curriculum can be adequately addressed in the time available (viability).
To Ensure an Effective Science Curriculum

Recommendations:

1. Identify and communicate the content considered essential.

2. Ensure that the essential content can be taught and learned in the amount of time available for instruction.

3. Sequence and organize the essential content to support student learning.

4. Protect the instructional time that is available and limit interruptions.
Where Do We Begin?

Begin with Current Curriculum Documents
<table>
<thead>
<tr>
<th>Physical</th>
<th>Life</th>
<th>Earth/Space</th>
<th>Engineering, Technology, and Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matter and Its Interactions</td>
<td>From Molecules to Organisms: Structures and Processes</td>
<td>Earth’s Place in the Universe</td>
<td>Engineering design</td>
</tr>
<tr>
<td>Motion and Stability: Forces and Interactions</td>
<td>Ecosystems: Interactions, Energy, and Dynamics</td>
<td>Earth Systems</td>
<td>Links among engineering, technology, science, and society</td>
</tr>
<tr>
<td>Energy</td>
<td>Heredity: Inheritance and Variation of Traits</td>
<td>Earth and Human Activity</td>
<td></td>
</tr>
<tr>
<td>Waves and Their Applications in Technologies for Information Transfer</td>
<td>Biological Evolution: Unity and Diversity</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Reflective practitioners compare the two documents to see how they are arranged.
Principles guiding the practices of implementing effective classroom curriculum design.

- Learning is enhanced when a teacher identifies specific learning goals that are the focus of a lesson and the unit.
- Learning requires engagement in tasks that are linked to the learning goals in ways that help develop understanding.
- Learning requires multiple exposures to and complex interactions with conceptual and procedural knowledge.
Challenging Science Content

Kathy Roth, 2010

- **AUS**: 57% Challenging, 43% Basic
- **CZE**: 65% Challenging, 35% Basic
- **JPN**: 53% Challenging, 47% Basic
- **NLD**: 52% Challenging, 48% Basic
- **USA**: 57% Challenging, 43% Basic
Weak or No Links Between Ideas and Activities

Kathy Roth, 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>Doing activities with no content</th>
<th>Learning content with weak or no conceptual links</th>
<th>Learning content with strong conceptual links</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS</td>
<td>12</td>
<td>30</td>
<td>58</td>
</tr>
<tr>
<td>CZE</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>JPN</td>
<td>6</td>
<td>24</td>
<td>70</td>
</tr>
<tr>
<td>NLD</td>
<td>8</td>
<td>65</td>
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</tr>
<tr>
<td>USA</td>
<td>27</td>
<td>44</td>
<td>30</td>
</tr>
</tbody>
</table>
Building a Content Storyline: Linking Ideas and Activities

Kathy Roth, 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>Explored a question</th>
<th>Discussed outcomes or conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUS</td>
<td>33</td>
<td>51</td>
</tr>
<tr>
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<td>20</td>
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<tr>
<td>JPN</td>
<td>49</td>
<td>55</td>
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<tr>
<td>NLD</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>USA</td>
<td>8</td>
<td>25</td>
</tr>
</tbody>
</table>
The findings show...

• In U.S. lessons, the focus was on doing activities with less attention to content and even less attention to linking activities and science ideas.

Kathy Roth, 2010
Let’s take a poll!

What 3 elements are needed for effective classroom lesson design?

A. Clear Learning Goals, Fun Activities, Assessments of Student Learning
B. Clear Learning Goals, Tasks Linked to Learning Goals, Multiple Learning Opportunities
C. Clear Learning Goals, Hands-on Activities, Engaged Students
D. Clear Learning Goals, Classroom Management, Safe and Orderly Classrooms
Learning Goal or Not a Learning Goal

• The main learning goal is **NOT** a topic, phrase, activity or question.
• The main learning goal **IS** a complete idea that can be stated in a sentence.
### Learning Goal vs. Phrases, Topics, Activities, & Questions

<table>
<thead>
<tr>
<th>Learning Goal</th>
<th>Not a Learning Goal</th>
</tr>
</thead>
</table>
| • Understand that: Static electricity is caused by the movement of charged particles. | • Electromagnetism (topic)  
  • Building a series circuit (activity)  
  • How switches work (phrase) |
| • Understand that: Plants make their own food through a process called photosynthesis, which occurs in the leaves. | • Photosynthesis (topic)  
  • Investigating plants in the light and in the dark (activity)  
  • What happens to plants in the dark? (question) |
| • Understand that: Water changes states as a result of thermal energy being added or lost. | • States of matter (topic)  
  • The water cycle (topic)  
  • Where does water go when it evaporates? (question) |
| • Understand that: If an object is not subjected to a force, it will continue moving at a constant speed and in a straight line. | • How are motion and force related? (question)  
  • The motion of an object (phrase) |
Quality Learning Goals

- Clear
- Manageable
- Appropriate to students’ learning needs
- Aligned with success criteria
- Communicated with students
Poll: Learning Goal?

A. What happens to plants in the dark?
B. Students will investigate plants in the light and in the dark.
C. Students will study photosynthesis.
D. Plants make their own food through the process of photosynthesis, which occurs in the leaves.
E. Plants store food in roots, stems, fruits, and seeds.
Electric Circuits Storyline
STC 4th Grade

Unifying Concepts:
- Systems, order and organization
- Evidence, models and explanations
- Change, constancy and measurement
- Evolution and equilibrium
- Form and function

Big Idea:
Electrical circuits require a complete circle through which an electrical current passes. Electricity in circuits can produce light, heat and other forms of energy.

RI Statements of Enduring Knowledge:
PS 2. Energy can be stored, transferred and transformed, but cannot be destroyed.

Sub Concept I: A complete electric circuit is required to light a light bulb.

- Lesson 1: Thinking About Electricity and Its Properties
  Discussing what students know and would like to know

- Lesson 2: What Electricity Can Do
  Discussing lighting a light bulb

- Lesson 3: A Closer Look at Circuits
  Looking at different ways to connect the parts

- Lesson 4: What Is Inside a Light Bulb?
  Understanding the parts of a bulb and the path of electricity through it

- Lesson 5: Building a Circuit
  Learning how to use devices to help build circuits

- Lesson 7: Conductors and Insulators
  Understanding the behavior of conductors and insulators

- Lesson 11: Exploring Series and Parallel Circuits
  Identifying and building series/parallel circuits

- Lesson 12: Learning About Switches
  Building switches and understanding why they are important

- Lesson 14: Working with a Diode
  Understanding how a diode works

- Lesson 8: Making a Filament
  Learning that electricity can be used to generate light and heat

- Lesson 10: Deciphering a Hidden Circuit
  Using what has been learned about series/parallel circuits to construct a flashlight

Sub Concept II: Different types of materials or devices do different jobs.
Different types of electric circuits show different characteristics.

- Lesson 9: Hidden Circuits
  Using a circuit tester to locate hidden conductors

- Lesson 6: What's Wrong with the Circuit?
  Using a circuit tester to troubleshoot

- Lesson 15: Planning and making a wiring system

Sub Concept III: Electricity can produce heat and light

Sub Concept IV: Strategies can be used to troubleshoot circuits

K-4 Assessment Target: Given a specific example or illustration (e.g., a simple closed circuit, rubbing hands together), predict the observable effects of energy (i.e., light bulb lights, a bell rings, hands warm up (e.g., a test item might ask, “What will happen when...?”))

RI GSEs for 3-4:
- Students demonstrate an understanding of energy by:
  - Describing or showing in many ways that heat can be produced (e.g., electricity, friction, burning).
  - Building a complete circuit; drawing and labeling diagrams of electrical circuits; and explaining what makes a complete circuit.
  - Using experimental data to classify a variety of materials as conductors or insulators.
  - Understanding an understanding of energy in their world by... (e.g., static electricity)
  - Making observations of natural phenomena (e.g., static electricity)

KITES 2006
East Bay Educational Collaborative
www.ebacc.org
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- Systems, order, and organization
- Evidence, models and explanations
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- Lesson 1: Thinking About Electricity and Its Properties
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- Lesson 2: What Electricity Can Do
  - Lighting a light bulb

- Lesson 3: A Closer Look at Circuits
  - Looking at different ways to connect the parts

- Lesson 4: What Is Inside a Light Bulb?
  - Understanding the parts of a bulb and the path of electricity through it

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- Lesson 12: Learning About Switches
  - Building switches and learning why they are important

- Lesson 14: Working with a Diode
  - Understanding how a diode works

- Lesson 8: Making a Filament
  - Learning that electricity can be used to generate light and heat

- Lesson 10: Deciphering a Hidden Language
  - Using symbols to create circuit diagrams which represent electrical circuits

- Lesson 15: Making and Using a Flashlight
  - Using what has been learned about series/parallel circuits to construct a flashlight

**Sub Concept II:** Different types of materials or devices do different jobs. Different types of electric circuits show different characteristics.

- Lesson 9: Hidden Circuits
  - Using a circuit tester to locate hidden conductors

**Sub Concept III:** Electricity can produce heat and light

- Lesson 6: What's Wrong with the Circuit?
  - Using a circuit tester to troubleshoot

- Lesson 13: Understanding the Components of a Circuit
  - Using switches to control circuits

- Lesson 16: Troubleshooting Circuits
  - Making effective wiring systems

K-4 Assessment Target: Given a specific example or illustration (e.g., simple closed circuit, rubbing hands together), predict the observable effects of energy (e.g., light bulb lights, a bell rings, hands warm up (e.g., a test item might ask, “What will happen when...?”)

RI GSSEs for 3-4: Students demonstrate an understanding of energy by...
- D Describing or showing in many ways that heat can be produced (e.g., electricity, friction, burning).
- D4 Building a complete circuit; drawing and labeling diagrams of electrical circuits; and explaining what makes a complete circuit.
- D4 Using experimental data to classify a variety of materials as conductors or insulators.
- Students demonstrate an understanding of energy in their world by...
- D4 Making observations of natural phenomena (e.g., static electricity)
RI Statement of Enduring Knowledge—Learning Goal

**PS 2** Energy is necessary for change to occur in matter. Energy can be stored, transferred and **transformed**, but cannot be destroyed.
Assessment Target:

Given a specific example or illustration (e.g., simple closed circuit, rubbing hands together), predict the observable effects of energy (i.e., light bulb lights, a bell rings, hands warm up) and explain what will happen. (e.g., a test item might ask, “what will happen when...?”)
**RI GSEs for 3-4:** Students demonstrate an understanding of energy by...

4c Describing or showing in many ways that heat can be produced (e.g., electricity, friction, burning).

4d Building a complete circuit; drawing and labeling diagrams of electrical circuits; and explaining what makes a complete circuit.

4e Using experimental data to classify a variety of materials as conductors or insulators

Students demonstrate an understanding of energy in their world by...

4f Making observations of natural phenomena (e.g., static electricity)
**Animals 2x2 Storyline**
FOSS Kindergarten

**Unifying Concepts:**
- System
- Pattern
- Change
- Interaction
- Structure

**Big Ideas:**
- Animals have characteristics and behaviors that are like one another in some ways, and different in other ways.
- Animals have unique features that help them live in different environments.
- Animals need certain things in order to live.

**RI Statements of Enduring Knowledge:**
1. All living organisms have identifiable structures and characteristics that allow for survival (organisms, populations, and species).

**Subconcept I:** Different fish have body parts and behaviors that are similar in some ways, and different in others.

**Activity 1.1**
The Structure of the Goldfish
- Identifying body parts and similarities among fish of the same type
- Observing goldfish behavior, especially around food and plants

**Activity 1.2**
Goldfish Behavior
- Observing goldfish behavior when a tunnel is placed in the aquarium

**Activity 1.3**
Fish Tunnels
- Observing goldfish behavior

**Activity 1.4**
Comparing Goldfish to Guppies
- Looking for similarities or differences in body parts, size, color, feeding habits, etc.

**Subconcept II:** Some land animals are very much like some water animals, but have different roles.

**Activity 2.1**
Land Snails
- Observing body parts and behaviors

**Activity 2.2**
Snail Races
- Observing how fast snails move

**Activity 2.3**
Observing land animals
- Identifying body parts and similarities and differences

**Activity 2.4**
Observing water animals
- Identifying body parts and similarities and differences

**Subconcept III:** Animals have structures and behaviors that are like in some ways and different in others.

**Activity 3.1**
The Structure of Earthworms
- Identifying body parts and features of earthworms

**Activity 3.2**
Earthworm Behavior
- Observing how earthworms move and react to different objects

**Activity 3.3**
Comparing Earthworms to Redworms
- Looking for similarities and differences in size, structure, and behavior

**Activity 4.1**
Isopod Observations
- Identifying and sorting on a similar or different external feature
- Observing how earthworms move and react to different objects

**Activity 4.2**
Identifying Isopods
- Identifying differences between sowbugs and pillbugs

**Activity 4.3**
Isopod Races
- Comparing the speed of two different isopods

**Activity 4.4**
Animals Living Together
- Identifying conditions which animals need to live

**RI K 4 Assessment Targets:**
- Sort/classify different living things using similar and different characteristics. Describe why organisms belong to each group or cite evidence about how they are alike or not alike.
- Identify the basic needs of plants and animals in order to stay alive. (i.e., water, air, food, space)
- Students demonstrate an understanding of classification of organisms by...
  1. Identifying and sorting based on a similar or different external feature.
  2. Observing and recording the external features that make up living things (e.g. roots, stems, leaves, flowers, legs, antennae, tail, shell).
- Observing that plants need water, air, food, and light to grow; observing that animals need water, air, food and shelter to grow.

XITE 2006
Fast Bay Educational Collaborative
www.ebcqi.org
## Animals 2x2 Storyline

**FOSS Kindergarten**

### Unifying Concepts:
- System
- Pattern
- Change
- Interaction
- Structure

### Big Ideas:
- Animals have characteristics and behaviors that are like one another in some ways, and different in other ways.
- Animals have unique features that help them live in different environments.
- Animals need certain things in order to live.

### RI Statements of Enduring Knowledge:

**LS 1 All Living organisms have remarkable structures and characteristics that allow for survival (organisms, populations, and species).**

### Subconcept I: Different fish have body parts and behaviors that are similar in some ways, and different in others.

<table>
<thead>
<tr>
<th>Activity 1.1</th>
<th>Activity 1.2</th>
<th>Activity 1.3</th>
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<tbody>
<tr>
<td>The Structure of the Goldfish</td>
<td>Goldfish Behavior</td>
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<td>Comparing Goldfish to Guppies</td>
</tr>
<tr>
<td>Identifying body parts, and similarities among fish of the same type</td>
<td>Observing goldfish behavior, especially around food and plants</td>
<td>Looking for similarities or differences in body parts, size, color, feeding habits, etc.</td>
<td></td>
</tr>
</tbody>
</table>

### Subconcept II: Some land animals are very much like some water animals, but have different ones.

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<thead>
<tr>
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<th>Activity 2.2</th>
<th>Activity 2.3</th>
<th>Activity 2.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Snails Observing body parts and behaviors</td>
<td>Land Snail Races Observing how fast snails move</td>
<td>Observing body parts and behavior for similarities and differences</td>
<td></td>
</tr>
<tr>
<td>Activity 3.1</td>
<td>Activity 3.2</td>
<td>Activity 3.3</td>
<td>Activity 4.1</td>
</tr>
<tr>
<td>Activity 3.4</td>
<td>Activity 3.5</td>
<td>Activity 4.2</td>
<td>Activity 4.3</td>
</tr>
<tr>
<td>Activity 4.4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Subconcept III: Animals have structures and behaviors that are like in some ways and different in others.

<table>
<thead>
<tr>
<th>Activity 3.1</th>
<th>Activity 3.2</th>
<th>Activity 3.3</th>
<th>Activity 4.1</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Structure of Earthworms</td>
<td>Earthworm Behavior</td>
<td>Observing how earthworms move and react to different objects</td>
<td>Comparing Earthworms to Redworms</td>
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<tr>
<td>Identifying body parts and features of earthworms</td>
<td>Observing how earthworms move and react to different objects</td>
<td>Looking for similarities and differences in size, structure and behavior</td>
<td></td>
</tr>
</tbody>
</table>

### Subconcept IV: Isopods have body parts and behaviors that are similar in some ways, and different in others.

<table>
<thead>
<tr>
<th>Activity 4.1</th>
<th>Activity 4.2</th>
<th>Activity 4.3</th>
<th>Activity 4.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Isopod Observations</td>
<td>Identifying Isopods</td>
<td>Isopod Races Comparing the speed of two different isopods</td>
<td>Animals Living Together</td>
</tr>
<tr>
<td>Looking at structures and behavior of an isopod</td>
<td>Identifying differences between sowbugs and pillbugs</td>
<td></td>
<td></td>
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</table>

### RI K4 Assessment Targets:
- Sort/classify different living things using similar and different characteristics. Describe why organisms belong to each group or cite evidence about how they are alike or not alike.
- Identify the basic needs of plants and animals in order to stay alive. (i.e., water, air, food, space)
- Students demonstrate an understanding of classification of organisms by...

1b Identifying and sorting based on a similar or different external feature.

1c Observing and recording the external features that make up living things (e.g., roots, stems, leaves, flowers, legs, antennae, tail, shell).

2a Observing that plants need water, air, food, and light to grow; observing that animals need water, air, food, and shelter to grow.
Big Idea

Animals are like one another other in some ways, and different in other ways.
RI Statement of Enduring Knowledge – Learning Goal

**PS 1** All living organisms have identifiable structures and characteristics that allow for survival
Assessment Target:

Sort/classify different living things using similar and different characteristics.
RI GSEs for 3-4: Students demonstrate an understanding of classification of organisms by...

1b identifying and sorting based on similar or different external features
1c observing and recording the external features that make up living things
Create a Frayer Model for Learning Goal and Success Criteria

- Definition – In your own words
- Characteristics
- Examples
- Non-examples
- Picture

Example Frayer Model

**Definition**
A traveling group of entertainers that includes trained animals

**Characteristics**
- Goes from town to town
- Has trained animals
- Has magicians
- Has jugglers and acrobats

**Examples**
- In our reading book
- On TV
- Barnum & Bailey Circus

**Non-examples**
- Zoo
- Puppet show
- Carnival

**Picture**
- Circus illustration with clowns and a clown on a unicycle
Create Your Frayer Model

- Definition
- Characteristics
- Picture
- Examples
- Non-examples

Learning Goal
Create Your Frayer Model

<table>
<thead>
<tr>
<th>Definition</th>
<th>Characteristics</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Examples</td>
<td>Non-examples</td>
<td></td>
</tr>
</tbody>
</table>

Success Criteria
Identify Learning Goals

Critical Questions:

• What are students going to learn in the learning sequence?
• Which ideas (concepts) matter most in the unit or lesson?
• What skills and/or processes are needed for the learning to occur?
• Too **BIG**:  
  – Students understand: Earth is a system that contains a fixed amount of each stable chemical element existing in different chemical forms. Each element on Earth moves among reservoirs in the solid Earth, ocean and atmosphere as part of biogeochemical cycles driven by energy from the Earth’s interior and from the Sun.

• Too **small**:  
  – Students understand: Chemicals exist in different forms.

• **Just Right**:  
  – Students understand: Energy can be transformed from one form to another.
<table>
<thead>
<tr>
<th>Big Idea:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning Goals</td>
</tr>
<tr>
<td>Success Criteria</td>
</tr>
<tr>
<td>Planning Template #2</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td><strong>Big Idea</strong></td>
</tr>
<tr>
<td>Description:</td>
</tr>
<tr>
<td><strong>Learning Goals</strong></td>
</tr>
<tr>
<td>Understand that:</td>
</tr>
<tr>
<td><strong>Success Criteria</strong></td>
</tr>
<tr>
<td>Students can:</td>
</tr>
</tbody>
</table>
Example: Science

Earth's water

- Oceans: 97.2%
- Lakes and rivers: 0.009%
- Groundwater: 0.62%
- Atmosphere: 0.001%
- Glaciers and ice sheets: 2.15%

Condensation forms clouds

Vapor released from plants

Runoff from land

Storage in lakes

Evaporation from lakes

Evaporation from the ocean

Storage as ice

Rain and snow

Underground channels

Ocean
**Big Idea:**
The cycling of water in and out of the atmosphere is a significant aspect of weather patterns.

<table>
<thead>
<tr>
<th>Learning Goals</th>
<th>Success Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students understand that:</td>
<td></td>
</tr>
<tr>
<td>• driven by the thermal energy of the sun, water is cycled between bodies of water, the atmosphere and the land.</td>
<td></td>
</tr>
<tr>
<td>• the water cycle is a continuous loop where water moves in and out of the air, water, land and the organisms that live there.</td>
<td></td>
</tr>
</tbody>
</table>
Now You Try It!

1. Review the criteria for what a learning goal is and isn’t. Refer to the examples provided.

2. Create your own learning goal using Handout 3.3.1.
Let’s Pause and Share
Raise Your Hand
Success Criteria Defined

• Ways that students express their understanding of the learning goal. Students provide evidence (i.e., able to say, do, think, present, develop or explain, etc).

• Success criteria are used as a check on learning.
Quality Success Criteria

- Clear
- Aligned with learning goals
- Fair and unbiased
- Communicated to the learner
- Made explicit through examples
<table>
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</thead>
<tbody>
<tr>
<td>Students understand that:</td>
<td>Student can:</td>
</tr>
<tr>
<td>• driven by the thermal energy of the sun, water is cycled between bodies of water, the atmosphere and the land.</td>
<td>• explain the effects of the sun on water (adding or removing heat/ energy).</td>
</tr>
<tr>
<td>• the water cycle is a continuous loop.</td>
<td>• represent how water moves continuously between the oceans, the lands and the atmosphere based on the amount of energy and the characteristics of the water, oceans, the air and the land.</td>
</tr>
</tbody>
</table>
Today we will be observing our grass plants and how they are doing in the light and in the dark.

Yesterday we defined food as matter that contains energy that living things can use to live and grow. Today we’re going to explore how plants get their energy-supplying food.

Plants Learning Goal:
Understand that plants use the energy in light to make sugars out of carbon dioxide and water. This food can be used immediately for fuel or materials or it may be stored for later use.
Water Cycle Learning Goal: Understand that water changes states when thermal energy is added.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Phrase</th>
<th>Understandable to Student</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ We're going to do an activity about the three states of water.</td>
<td>✓ We're going to learn about thermal energy.</td>
<td>✓ We're going to learn how ice changes when we heat it.</td>
</tr>
</tbody>
</table>
Match Activities to Learning Goals

• Look at your learning goal and success criteria.

• Review examples from your own lessons to determine how well the activities match your learning goals.

• Using the information on your planning sheet, write the learning goal in a way that your students can understand.
Let’s Pause for Questions.
If you were to do only **one thing** when you return to school to change the odds for your students, what would it be?
Contacting McREL

- General inquiries: [www.mcrel.org](http://www.mcrel.org)
- Designing Effective Science Instruction: [atweed@mcrel.org](mailto:atweed@mcrel.org), 303-632-5528
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Welcome to Your Personalized Learning Web Space!

Paul, you've already earned **1335 Activity Points**!

You've recently earned:
- **Ruby Aggregator**
- Add Personal Resources

You're close to earning:
- **Ruby Commenter**
- Post 9 more comments/questions

**Activity Progress Bar**

Your Activity Matters!
It reduces your carbon footprint!

**Lorrie Armfield**
Last Week's Top Advocate

With these resources you can build your professional development plan, track your activities and assess your progress. You can start at "Explore Learning Opportunities" below or by creating your game plan with the PD Plan and Portfolio tool. You may also review an archived Web Seminar or a multimedia overview of the Learning Center.

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**Explore Learning Opportunities**

- Advanced Search
- See all FREE Lesson Plans
- See all FREE Resources

By Subject  |  By Grade Level  |  By State Standards
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