

Professional Development Documents: Developing Learning Progressions

In this packet you will find a set of handouts and support materials for the Developing Learning Progressions professional development module. These documents represent the work of the leadership of the Assessing with Learning Progressions in Science Project, a Math Science Partnership through the Northwest Educational Service District in Washington State. We encourage others to use these materials as part of their own professional development programs. The PowerPoint which contains presentation notes and instructions for use of these materials can be found on the professional development tools section of the ALPS project web page www.nwesd.org/nwalps. For access to editable versions of these documents please contact Nancy Menard nmenard@nwesd.org.

Description of the Enclosed Documents

Learning Progression Template

Blank learning progression template for use in the creation of new learning progressions. Poster sized copied of the templates it can be very helpful for teams building progressions collaboratively. If you have the ability to also print.

Formative Assessment Learning Progression

This learning progression describes a pathway to developing an understanding of formative assessment

Building a Learning Progression

This document details a step by step process for creating learning progression

Peer Assessment Sheet

This form can be used by participants to provide peer assessment feedback on learning progressions

Rubric for Learning Progression

This rubric can be used for peer and self assessment of learning progressions

Learning progression self assessment

This document provides guiding questions that can be used to self assess the strength of a learning progression

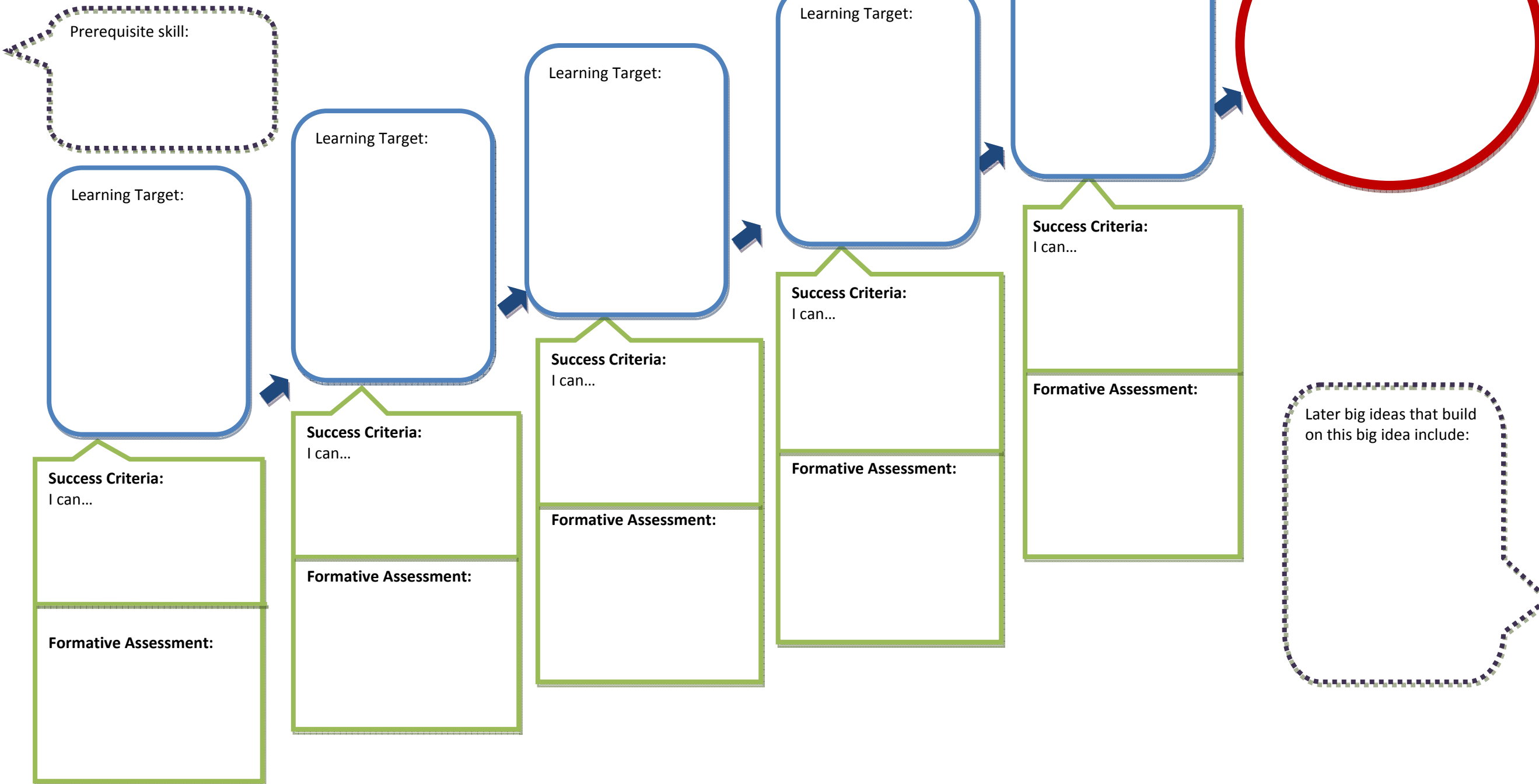
Sample Learning Progression with Step-by-Step Creation Description

This document provides an example of the steps of learning progression creation using a commonly used instructional material FOSS: Matter and Energy

Learning Progression

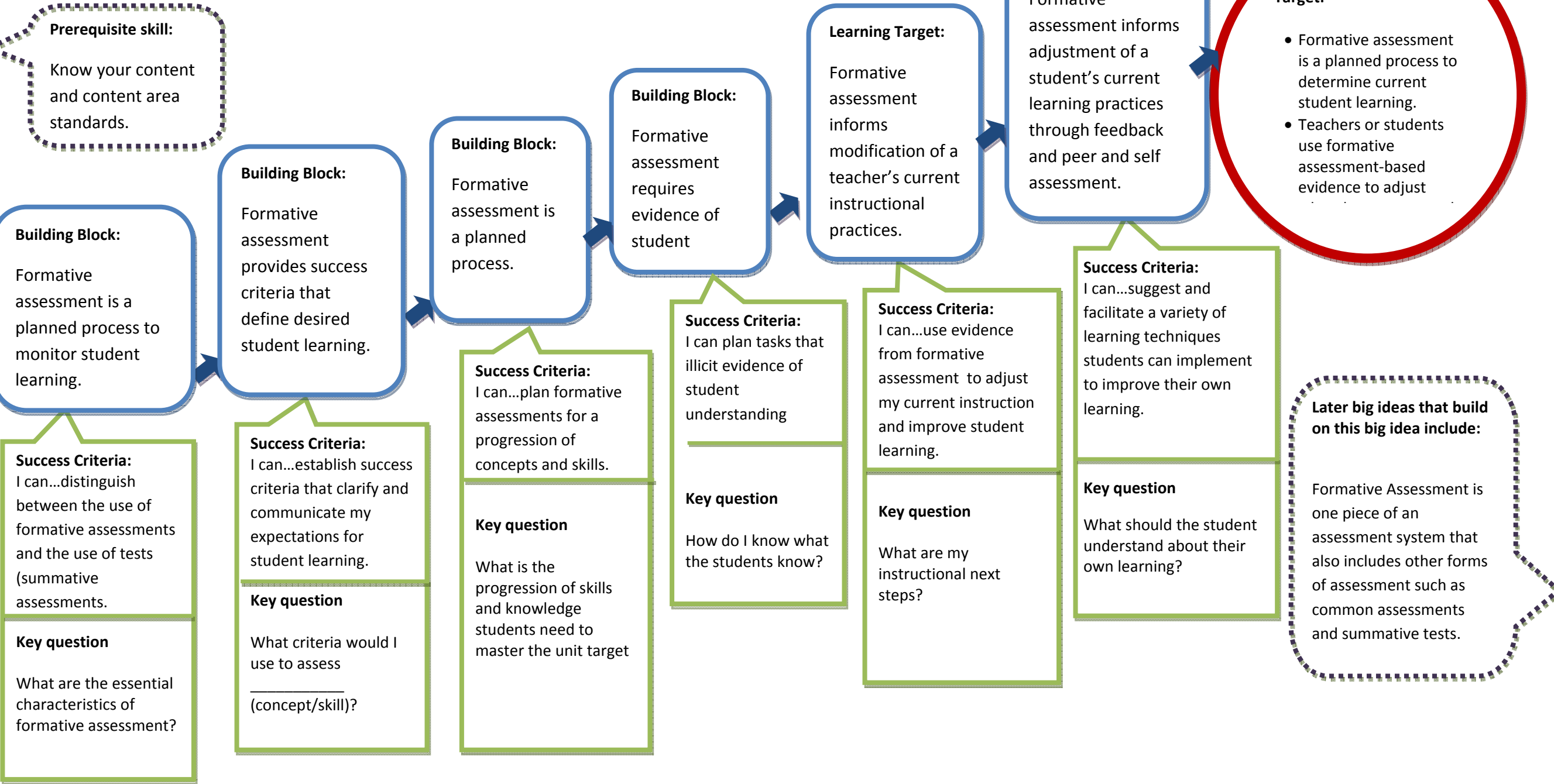
Materials:

Grade level:



Learning Progression

Formative Assessment: a process for making instruction more effective in order to improve student learning.



Building a Learning Progression for a Curriculum Unit			Example		
1.	Identify 3 to 4 big ideas.	<ul style="list-style-type: none"> Match the state science standards' big ideas and core content to the content of your teacher's guide. Select three to four big ideas from the state standards that best fit the content of your teacher's guide. Record each big idea on a sticky note 	State Science Standards Big Idea: Energy: Transfer, transformation, and Conservation	FOSS Matter and Energy ; Investigation 1 Big Idea Energy has many forms hat can be transformed (changed) and transferred (moved). Etc.	
2.	Identify concepts.	<ul style="list-style-type: none"> Find the concepts listed in the overview section of your teacher's guide. Write each concept at the top of a sticky note. Post each concept with its overarching big idea. 	FOSS Inv. 1, part 1 <ul style="list-style-type: none"> Energy takes many forms. Energy can be carried from one place to another by waves, electric current, and moving objects. Energy can be converted to other forms of energy. Etc. 		
3.	Meld state standards with curriculum concepts.	<ul style="list-style-type: none"> Find the state standards that correlate with concepts from the teacher's guide. Record state standards on the sticky notes with correlating concepts from the teacher's guide. 	For instance, FOSS Inv.1, part 2: "Energy can be converted to other forms of energy," correlates with>>> State science standard: 4-5 PS3B: "Energy can be transformed from one form to another."		
4.	Find state standards lurking in lessons.	<ul style="list-style-type: none"> Search the lessons in your teacher's guide for state standards that are not listed in the teacher's guide overview. Record each standard you find on a sticky note and post it with the appropriate big idea. 	For instance, standard 4-5 PS3D:" Sound energy can be generated by vibrations" [kinetic (movement) energy], is a state standard. This concept is in FOSS Matter and Energy, Inv. 1, Part 3; but it is not listed as a concept in the overview of the teacher's guide.		
5.	Organize the concepts.	Group the concepts/standards for each big idea with like concepts.	<ul style="list-style-type: none"> FOSS Inv. 1, part 1 and 2: Machines and living things can convert energy into motion and heat. 4-5 PS3Ca: Heat energy can be generated a number of ways. FOSS Inv.1, part 2: Energy can be converted to other forms of energy. 4-5 PS3B: Energy can be transformed from one form to another. Etc. 		
6.	Establish progressive learning targets.	<ul style="list-style-type: none"> Arrange the groups in a hierarchy that builds to the big idea. Synthesize each group of concepts into a learning target Post the learning targets in a progression that builds to the big idea. 	Learning Target 1 Energy has many forms. Inv. 1, Part 1 3 sessions	Learning Target 2 Energy can be changed from one form to another form. Inv. 1, Part 2 3 sessions	Learning Target 3 Energy can move from one place to another. Inv. 1, Part 3 3 sessions Etc.
7.	Identify prerequisite skills and later big ideas.	<ul style="list-style-type: none"> Look at the state standards' big ideas and core content for the previous grade band Post this content as the prerequisite skill. Look at the state standards' big ideas and core content for the following grade band. Post this content as the later big ideas. 	Prerequisite skill: Different forms of energy are used in everyday activities. Grades 2-3		Later big ideas that build on this big idea include: <ul style="list-style-type: none"> Heat energy (thermal) always moves from a warmer to a cooler place. Electrical energy is a convenient way to transfer energy. Sound energy is produced by a vibrating object. Grades 6-8
8.	Establish success criteria and plan formative assessment.	<ul style="list-style-type: none"> Establish success criteria that provide evidence of student mastery of each learning target. Turn the success criteria into student friendly statements. Plan formative assessments that apply to the success criteria for each learning target 	Success Criteria: I can identify different forms of energy in a system.		Formative Assessment: Exit ticket: Students identify the forms of energy in a given system and note them on a card.



<p>Learning Target:</p> <p>Learning progressions build on precursory skills and knowledge needed to master the big idea.</p> <p>Success Criteria:</p> <p>Each learning target specifies what the students will <i>learn</i> rather than the activity the students will <i>do</i>.</p>	<p>Identify where the learning progression shows strengths for this target:</p> <p>Identify where and how on the learning progression this target can be improved:</p>
<p>Learning Target:</p> <p>Learning progressions build from less difficult to more difficult items in an appropriate grain size.</p> <p>Success Criteria:</p> <p>The learning targets are sequenced in a hierarchy of learning to build student competence as difficulty increases.</p>	<p>Identify where the learning progression shows strengths for this target:</p> <p>Identify where and how on the learning progression this target can be improved:</p>

Rubric for Learning Progressions

Component	3: Ready to put in practice	2: Needs some modification	1: Needs a complete overhaul
Big Idea	The big idea is a concept that clearly aligns with a science standard big idea. <i>e.g., All plants and animals have life cycles.</i>	The big idea is stated in language that is difficult to align with a science standard. <i>e.g., Plants and animals have interesting lives.</i>	The big idea does not align with a science standard. <i>e.g., A Monarch is a kind of butterfly.</i>
Learning Targets	Each learning target states a precursory skill (cognitive understanding) or body of knowledge (information) needed to master the big idea. <i>e.g., Skill: Distinguish between the life cycle of a plant and the life cycle of an animal.</i> <i>e.g., Body of knowledge: Animals have life cycles that include</i> <ol style="list-style-type: none">1. <i>being born;</i>2. <i>developing into juveniles, adolescents, adults;</i>3. <i>reproducing;</i>4. <i>and eventually dying</i>	The context in which the learning target will be framed is written as part of the learning target. <i>e.g., In its life cycle, a butterfly develops from egg to larva to pupa to adult.</i>	Skills unrelated to the big idea are stated as learning targets. <i>e.g., Butterflies have wings.</i> The learning target identifies the activity the students will do rather than what they will learn. <i>e.g., Students will record observations of a butterfly's life cycle.</i>
Progression	The learning targets are sequenced in progressively sophisticated ways of thinking about the big idea.	The learning targets need to be rearranged to develop a sequential progression to the big idea.	The learning targets do not represent knowledge and skills needed to master the big idea over time.
Success Criteria	The success criteria are descriptions and/or examples of learning target achievement written in student friendly language. <i>e.g., I can compare the life cycles of two different animals.</i>	The success criteria are written in language difficult for students to understand. <i>e.g., I can compare and contrast life processes of a mammal with the life processes of an amphibian.</i>	The success criteria are stated as a prescribed number of correct answers or the number of times something is included in a product or performance. <i>e.g., I can correctly name three stages in an animal's life cycle.</i> The success criteria are not aligned to the learning targets. <i>e.g., I can write a story about butterflies.</i>
Formative Assessments	The assessments are developed to elicit responses that can be used to determine student proficiency of the learning targets.	Some assessments require the students to do extra work that is not needed to determine proficiency of the learning targets.	The assessments are not aligned to the learning targets.

Assessing with Learning Progressions in Science

Math Science Partnership

File Name: Rubric for Learning Progressions

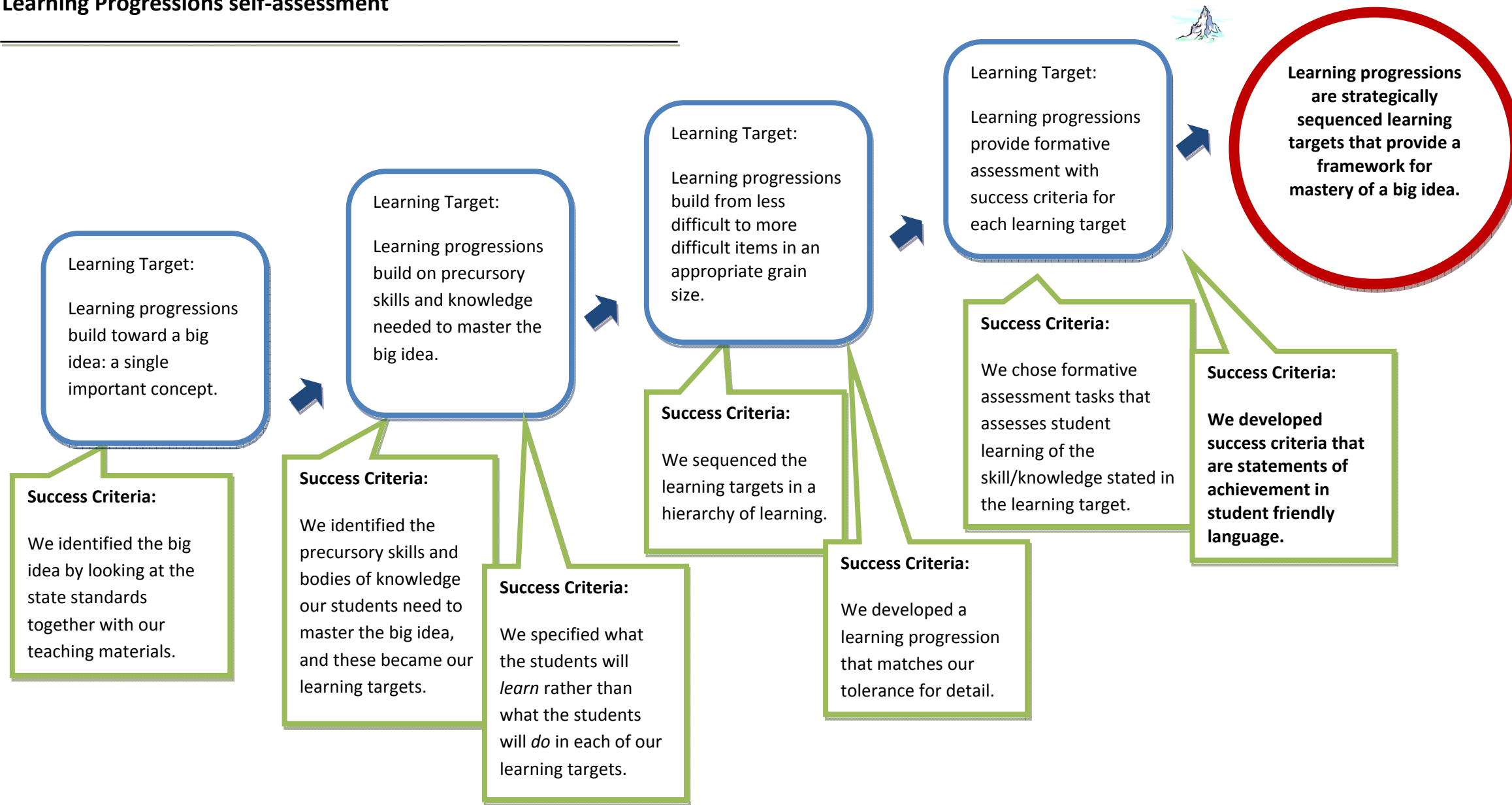
Funding information:

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Learning Progressions self-assessment



My Learning Progression

FOSS Matter and Energy, Investigation 1

EALR 4: Physical Science; **Big Idea:** Energy Transfer, Transformation and Conservation; **Core Content:** Heat, Light, Sound, and Electricity

Prerequisite knowledge:

- Different forms of energy are used in everyday activities grades 2-3

I can identify different forms of energy in a system. 4-5 PS3 A

Inv. 1 Part 1 (3 sessions)

Form. Assess. Task:
While observing an electric circuit system, list forms of energy in the system: i.e., in an electric motor system: electricity, motion, sound, heat.

Form. Assess. Technique:
Exit ticket. Students write list on a card.

I can describe how energy can be changed from one energy form to another energy form. 4-5 PS3 E

Inv.1 Part 2 (3 sessions)

Form. Assess. Task:
Describe how a truck that uses gasoline for fuel can be said to be powered by sunlight.

Form. Assess. Technique:
5 minute essay: Embedded. Students complete FOSS Sci. Notebook Sht. 5, "Energy"

I can draw and label diagrams that show energy can be transferred from one place to another. 4-5 PS3 B, C, D

Inv. 1 Part 3 (3 sessions)
Preteach energy diagrams

Form. Assess. Task:
Draw and label diagrams of energy transfers in given energy systems.

Form. Assess. Technique:
Embedded. Students complete FOSS Sci. Notebook Sht.s 6-7, with the addition of a labeled diagram for each system.

I can describe energy in an electrical system: 4-5 PS3 E

Extension (not in FOSS) Students rotate through inquiry centers.

Form. Assess. Task:

- Given a diagram of a battery-bulb electrical system with a missing part, students draw in the missing part and complete the diagram by labeling electrical energy transfers from one part to another and/or changes from electrical energy to different form(s) of energy.
- Students explain in writing that an electric circuit requires a complete loop of conducting materials for the system to work.

Form. Assess. Technique:
10 min. Quick Write/Quick Draw

I can describe how energy can be transferred from one place to another and changed from one form to another.

Later big ideas that build on this big idea include:

- Energy can be transformed grades 6-8
- Energy can neither be created nor destroyed (conservation) grades 9-12



Step 1: Identify 3 to 4 big ideas.

FOSS Matter and Energy

FOSS Matter and Energy, Investigation 1

Investigation 1

Big Idea: Energy:

Transfer, transformation, and Conservation

- Energy comes in many forms.
- Energy can be transferred from one place to another.
- Energy can be transformed from one form to another

Investigation 1 Big Idea

Energy has many forms that can be transformed (changed) and transferred (moved).

FOSS Matter and Energy, Investigation 2

Investigation 2

Big Idea: Inquiry:

Evidence

- Scientific explanations emphasize evidence. . . .

Investigation 2 Big Idea:

Scientific explanations emphasize evidence.

All but one of the FOSS Matter and Energy concepts in investigation 2 are part of Standard PS3D for grades 6-8:

“Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye.”

Since this content is a 6-8 science standard, I looked closely at the investigation to see if one of the cross cutting standards at the 4-5 level is applicable to the lessons. Providing evidence is a good fit with the FOSS materials.

FOSS Matter and Energy, Investigation 3

Investigation 3

Big Idea: Matter:

Properties and Change

- Matter may exist in different states – solid, liquid, gas.

Big Idea: Inquiry:

Evidence

- Scientific explanations emphasize evidence. . . .

Investigation 3 Big Ideas:

Matter may exist in different states - solid, liquid, gas.

Scientific explanations emphasize evidence.

FOSS Matter and Energy, Investigation 4

Investigation 4

Big Idea: Matter:

Properties and Change

- Matter can be changed from one state to another by heating or cooling.

Investigation 4 Big Idea:

Matter can be changed from one state to another by heating or cooling.

Step 2: Identify concepts listed in teaching materials.

Foss Matter and Energy



FOSS Inv. 1, part 1
Energy makes things happen.

FOSS Inv. 1, part 1
Most of the energy used by living things comes from the sun in the form of light.

Inv. 1, part 3
Energy can be carried from one place to another by waves, electric current, and moving objects.

Investigation 1

Big Idea:
Energy has many forms that can be transformed (changed) and transferred (moved).

FOSS Inv. 1, part 1
Energy takes many forms.

FOSS Inv. 1, part 1 and 2
Machines and living things can convert energy into motion and heat.

FOSS Inv. 1, part 1
Energy can be stored.

FOSS Inv.1, part 2
Energy can be converted to other forms of energy.

Step 2: Identify concepts listed in teaching materials.

Foss Matter and Energy



All but one of the *FOSS Matter and Energy* content concepts in investigation 2 are part of Standard PS3D for grades 6-8:

“Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye.”

The final concept in Investigation 2 is not stated in the standards.

The content concept written on each Post-it Note is the FOSS concept.

Through investigation into this content, the students learn to provide evidence to back up their explanations of the visual phenomena.

*FOSS Inv. 2, Part 1
Light can reflect off surfaces that it strikes.*

*FOSS Inv. 2, Part 2
White light is a mixture of all colors of light.*

Investigation 2

*Big Idea
Scientific explanations emphasize evidence.*

*FOSS Inv. 2, Part 1
A mirror is a smooth reflective surface.*

*FOSS Inv. 2, Part 2
Light can be absorbed by matter.*

*FOSS Inv. 2, Part 2
A shadow is created when an opaque object blocks light.*

*FOSS Inv. 2, Part 1
Light is a form of energy that travels in straight lines from a light source.*

*FOSS Inv. 2, Part 1
An object is seen only when light from that object enters an eye.*

*FOSS Inv. 2, Part 2
The apparent color of an object is a result of the light it reflects.*

Step 2: Identify concepts listed in teaching materials.

Foss Matter and Energy



FOSS Inv.3, Part 1
Common matter on Earth has three forms (states): solid, liquid, and gas.

FOSS Inv. 3, part 2
A measurement standard is a unit agreed upon and used by a large number of people.

FOSS Inv. 3, part 2
Opinion is based on belief; scientific evidence is based on observation.

Investigation 3
Big Ideas:
Matter may exist in different states - solid, liquid, gas.
Scientific explanations emphasize evidence.

FOSS Inv. 3, part 2
Measurement is used to quantify observations.

FOSS Inv. 3, part 2
The gram (g) is the standard unit of measure used to quantify mass in the metric system.

FOSS Inv. 3, part 2
Volume is a measure of the three-dimensional space occupied by matter.

FOSS Inv. 3, part 3
The liter (L) is the standard for measuring fluid volume in the metric system.



FOSS Inv. 4, part 1

Degrees Celsius (°C) is the unit used when scientists measure temperature.

FOSS Inv. 4, part 1

Melting occurs when solids are heated.

FOSS Inv. 4, part 1

Different substances melt at different temperatures.

FOSS Inv. 4, part 2

Evaporation occurs when liquids are heated.

FOSS Inv. 4, part 2

All matter on Earth is made of tiny particles.

Investigation 4

Big Ideas:

Matter can be changed from one state to another by heating or cooling.

FOSS Inv. 4, part 3

When two substances are combined, a reaction may occur, producing a new substance with unique properties.



FOSS Inv. 1, part 1

Energy makes things happen.

FOSS Inv. 1, part 1

Energy can be stored.

FOSS Inv. 1, part 1 and 2

Machines and living things can convert energy into motion and heat.

4-5 PS3Ca

Heat energy can be generated a number of ways.

Investigation 1
Big Idea:

Energy has many forms that can be transformed (changed) and transferred (moved).

FOSS Inv. 1, part 1

Energy takes many forms.

4-5 PS3A

Energy has many forms, such as heat, light, sound, motion, and electricity.

FOSS Inv.1, part 2

Energy can be converted to other forms of energy.

4-5 PS3B

Energy can be transformed from one form to another.

FOSS Inv. 1, part 1

Most of the energy used by living things comes from the sun in the form of light.

Inv. 1, part 3

Energy can be carried from one place to another by waves, electric current, and moving objects

4-5 PS3B

Energy can be transferred from one place to another.

All but one of the *FOSS Matter and Energy* concepts in investigation 2 are part of Standard PS3D for grades 6-8:

“Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye.”

The final concept in Investigation 2 is not stated in the standards.



*Investigation 2
Big Idea:*

Scientific explanations emphasize evidence.

*FOSS Inv. 2, Part 2
White light is a mixture of all colors of light.*

4-5 INQA

Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 1

A mirror is a smooth reflective surface.

*FOSS Inv. 2, Part 2
Light can be absorbed by matter.*

4-5 INQA

Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 1

An object is seen only when light from that object enters an eye.

*FOSS Inv. 2, Part 2
The apparent color of an object is a result of the light it reflects.*

4-5 INQA

Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 2

A shadow is created when an opaque object blocks light.

FOSS Inv. 2, Part 1

Light is a form of energy that travels in straight lines from a light source.

FOSS Inv. 2, Part 1

Light can reflect off surfaces that it strikes.



FOSS Inv.3, Part 1
Common matter on Earth has three forms (states): solid, liquid, and gas.
4-5 PS2Aa
Matter can exist in different states: solid, liquid, gas.

FOSS Inv. 3, part 2
Measurement is used to quantify observations.

FOSS Inv. 3, part 2
Volume is a measure of the three-dimensional space occupied by matter.

Investigation 3
Big Ideas:
Matter may exist in different states - solid, liquid, gas.
Scientific explanations emphasize evidence.

FOSS Inv. 3, Part 1
4-5 PS2Ba
Air is a gas.
Air fills a closed container completely.

FOSS Inv. 3, part 2
A measurement standard is a unit agreed upon and used by a large number of people.

FOSS Inv. 3, part 2
Opinion is based on belief; scientific evidence is based on observation.
4-5 INQG
Scientific explanations emphasize evidence. . . .

FOSS Inv. 3, part 3
The liter (L) is the standard for measuring fluid volume in the metric system.

FOSS Inv. 3, part 2
The gram (g) is the standard unit of measure used to quantify mass in the metric system.



FOSS Inv. 4, part 1

Degrees Celsius (°C) is the unit used when scientists measure temperature.

FOSS Inv. 4, part 1

Different substances melt at different temperatures.

FOSS Inv. 4, part 2

All matter on Earth is made of tiny particles.

**Investigation 4
Big Idea:**

Matter can be changed from one state to another by heating or cooling.

FOSS Inv. 4, part 1

Melting occurs when solids are heated.

FOSS Inv. 4, part 2

Evaporation occurs when liquids are heated.

FOSS Inv. 4, part 3

When two substances are combined, a reaction may occur, producing a new substance with unique properties.

4-5 PS2Ab

Heating or cooling can change matter from one form to another.

4-5 PS2Ab

Heating or cooling can change matter from one form to another.



FOSS Inv. 1, part 1

Energy makes things happen.

FOSS Inv. 1, part 1

Energy takes many forms.

4-5 PS3A

Energy has many forms, such as heat, light, sound, motion, and

FOSS Inv. 1, part 1

Energy can be stored.

FOSS Inv. 1, part 1

Most of the energy used by living things comes from the sun in the form of light.

FOSS Inv. 1, part 1 and 2

Machines and living things can convert energy into motion and heat.

4-5 PS3Ca

Heat energy can be generated a number of ways.

FOSS Inv.1, part 2

Energy can be converted to other forms of energy.

4-5 PS3B

Energy can be transformed from one form to another.

Inv. 1, part 3

Energy can be carried from one place to another by waves, electric current, and moving objects

4-5 PS3B

Energy can be transferred from one place to another.

FOSS Inv. 1, part 3

4-5 PS3D

Sound energy can be generated by making things vibrate.

FOSS Inv. 1, part 3

4-5 PS3D PE

Sound energy is transferred through the air from a source to a receiver.

Investigation 1 Big Idea:

Energy has many forms that can be transformed (changed) and transferred (moved).

Step 4: Find standards lurking in lessons.

All but one of the *FOSS Matter and Energy* concepts in investigation 2 are part of Standard PS3D for grades 6-8:

“Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye.”

The final concept in Investigation 2 is not stated in the standards.



**Investigation 2
Big Idea:**

Scientific explanations emphasize evidence.

FOSS Inv. 2, Part 1

Light is a form of energy that travels in straight lines from a light source.

FOSS Inv. 2, Part 1

Light can reflect off surfaces that it strikes.

FOSS Inv. 2, Part 1

A mirror is a smooth reflective surface.

FOSS Inv. 2, Part 1

An object is seen only when light from that object enters an eye.

FOSS Inv. 2, Part 2

White light is a mixture of all colors of light.

4-5 INQA

Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 2

Light can be absorbed by matter.

4-5 INQA

Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 2

The apparent color of an object is a result of the light it reflects.

4-5 INQA

Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 2

A shadow is created when an opaque object blocks light.

Step 4: Find standards lurking in lessons.

FOSS Matter and Energy



FOSS Inv.3, Part 1
Common matter on Earth has three forms (states): solid, liquid, and gas.

4-5 PS2Aa

Matter can exist in different states: solid, liquid, gas.

FOSS Inv. 3, part 2

Measurement is used to quantify observations.

FOSS Inv. 3, part 2

Volume is a measure of the three-dimensional space occupied by matter.

Investigation 3
Big Ideas:

Matter may exist in different states - solid, liquid, gas.

Scientific explanations emphasize evidence.

FOSS Inv. 3, Part 1

4-5 PS2Ba

Air is a gas.

Air fills a closed container completely.

FOSS Inv. 3, part 2

A measurement standard is a unit agreed upon and used by a large number of people.

FOSS Inv. 3, part 2

Opinion is based on belief; scientific evidence is based on observation.

4-5 INQG

Scientific explanations emphasize evidence. . . .

FOSS Inv. 3, part 2

The gram (g) is the standard unit of measure used to quantify mass in the metric system.

FOSS Inv. 3, part 3

The liter (L) is the standard for measuring fluid volume in the metric system.

Step 4: Find standards lurking in lessons.

FOSS Matter and Energy

FOSS Inv. 4, part 1

Degrees Celsius ($^{\circ}\text{C}$) is the unit used when scientists measure temperature.

FOSS Inv. 4, part 1

Different substances melt at different temperatures.

FOSS Inv. 4, part 2

All matter on Earth is made of tiny particles.



Investigation 4
Big Idea:

Matter can be changed from one state to another by heating or cooling.

FOSS Inv. 4, part 1

Melting occurs when solids are heated.

FOSS Inv. 4, part 2

Evaporation occurs when liquids are heated.

FOSS Inv. 4, part 3

When two substances are combined, a reaction may occur, producing a new substance with unique properties.

4-5 PS2Ab

Heating or cooling can change matter from one form to another.

4-5 PS2Ab

Heating or cooling can change matter from one form to another.

FOSS Inv. 4, part 2

4-5 PS2C

The total amount of matter is conserved (stays the same) when it undergoes a physical change (i.e. is broken or changes state).



Learning Target:
Energy has many forms.
Inv. 1, Part 1
3 sessions

FOSS Inv. 1, part 1
Energy makes things happen.

FOSS Inv. 1, part 1
Energy takes many forms.
4-5 PS3A
Energy has many forms, such as heat, light, sound, motion, and electricity.

FOSS Inv. 1, part 1
Energy can be stored.

FOSS Inv. 1, part 1
Most of the energy used by living things comes from the sun in the form of light.

Learning Target:
Energy can be changed from one form to another form.
Inv. 1, Part 2
3 sessions

FOSS Inv. 1, part 1 and 2
Machines and living things can convert energy into motion and heat.
4-5 PS3Ca
Heat energy can be generated a number of ways.

FOSS Inv.1, part 2
Energy can be converted to other forms of energy.
4-5 PS3B
Energy can be transformed from one form to another.

Learning Target:
Energy can move from one place to another.
Inv. 1, Part 3
3 sessions

Inv. 1, part 3
Energy can be carried from one place to another by waves, electric current, and moving objects
4-5 PS3B
Energy can be transferred from one place to another.

FOSS Inv. 1, part 3
4-5 PS3D
Sound energy can be generated by making things vibrate.

FOSS Inv. 1, part 3
4-5 PS3D PE
Sound energy is transferred through the air from a source to a receiver.

Investigation 1
Big Idea:
Energy has many forms that can be transformed (changed) and transferred (moved).



All but one of the *FOSS Matter and Energy* concepts in investigation 2 are part of Standard PS3D for grades 6-8:

“Visible light from the Sun is made up of a mixture of all colors of light. To see an object, light emitted or reflected by that object must enter the eye.”

The final concept in Investigation 2 is not stated in the standards.

Learning Target:
Evidence is gathered to help answer questions.
Inv. 2, Part 1, 3 sessions

FOSS Inv. 2, Part 1
Light is a form of energy that travels in straight lines from a light source.

FOSS Inv. 2, Part 1
Light can reflect off surfaces that it strikes.

FOSS Inv. 2, Part 1
A mirror is a smooth reflective surface.

FOSS Inv. 2, Part 1
An object is seen only when light from that object enters an eye.

Learning Target:
Scientific investigations involve asking questions and gathering evidence.
Inv.2, Part 2, 4 sessions

FOSS Inv. 2, Part 2
White light is a mixture of all colors of light.
4-5 INQA
Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

FOSS Inv. 2, Part 2
Light can be absorbed by matter.
4-5 INQA
Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

4-5 INQA
Scientific investigations involve asking and answering questions and comparing the answers with evidence from the real world.

A shadow is created when an opaque object blocks light.

*Investigation 2
Big Idea:
Scientific explanations emphasize evidence.*



Learning Target:
Matter can exist in different states.
Inv. 3, Part 1, 3 sessions..

FOSS Inv.3, Part 1
Common matter on Earth has three forms (states): solid, liquid, and gas.
4-5 PS2Aa
Matter can exist in different states: solid, liquid, gas.

FOSS Inv. 3, Part 1
4-5 PS2Ba
Air is a gas.
Air fills a closed container completely.

Learning Target:
Evidence is based on observation and data.
Inv. 3, Part 2, 4 sessions

FOSS Inv. 3, part 2
Measurement is used to quantify observations.

FOSS Inv. 3, part 2
A measurement standard is a unit agreed upon and used by a large number of people.

FOSS Inv. 3, part 2
The gram (g) is the standard unit of measure used to quantify mass in the metric system.

FOSS Inv. 3, part 2
Volume is a measure of the three-dimensional space occupied by matter.

FOSS Inv. 3, part 2
Opinion is based on belief; scientific evidence is based on observation.

4-5 INQG
Scientific explanations emphasize evidence. . . .

Learning Target:
Matter can exist in different states.
Inv. 3, Part 3, 4 sessions..

FOSS Inv. 3, part 3
A measurement standard is a unit agreed upon and used by a large number of people.

FOSS Inv. 3, part 3
The liter (L) is the standard for measuring fluid volume in the metric system.

FOSS Inv.3, Part 3
Common matter on Earth has three forms (states): solid, liquid, and gas.
4-5 PS2Aa
Matter can exist in different states: solid, liquid, gas.

Investigation 3
Big Ideas:
Matter may exist in different states - solid, liquid, gas.
Scientific explanations emphasize evidence.



Learning Target:

Heating or cooling can change matter from one form to another.

Inv. 4, Part 1. 1 session

FOSS Inv. 4, part 1

Degrees Celsius ($^{\circ}\text{C}$) is the unit used when scientists measure temperature.

FOSS Inv. 4, part 1

Melting occurs when solids are heated.

4-5 PS2Ab

Heating or cooling can change matter from one form to another.

FOSS Inv. 4, part 1

Different substances melt at different temperatures.

Learning Target:

Heating or cooling can change matter from one form to another.

Inv. 4, Part 2, 4 sessions

Evaporation occurs when liquids are heated.

4-5 PS2Ab

Heating or cooling can change matter from one form to another.

FOSS Inv. 4, part 2

All matter on Earth is made of tiny particles.

Learning Target:

The total amount of matter stays the same (is conserved) when it changes from one form to another.

Inv. 4, Part 3, 4 sessions

When two substances are combined, a reaction may occur, producing a new substance with unique properties.

FOSS Inv. 4, part 3

4-5 PS2C

The total amount of matter is conserved (stays the same) when it undergoes a physical change (i.e. is broken or changes state).

Investigation 4 Big Idea:

Matter can be changed from one state to another by heating or cooling.

Learning Progression

FOSS Matter and Energy, Investigation 1

Prerequisite skill:
Different forms of energy are used in everyday activities. Grades 2-3

Learning Target:
Energy has many forms.
Inv. 1, Part 1,
3 sessions

Success Criteria:
I can...

Formative Assessment:

Learning Target:
Energy can be changed from one form to another form (transformed).
Inv. 1, Part 2,
3 sessions

Success Criteria:
I can...

Formative Assessment:

Learning Target:
Energy can move from one place to another (transferred).
Inv. 1, Part 3,
3 sessions

Success Criteria:
I can...

Formative Assessment:



Unit Target:
Energy has any forms that can be transformed (changed) and transferred (moved).

Later big ideas that build on this big idea include:

- Heat energy (thermal) always moves from a warmer to a cooler place.
- Electrical energy is a convenient way to transfer energy.
- Sound energy is produced by a vibrating object.

Grades. 6-8

Learning Progression

FOSS Matter and Energy, Investigation 1: Energy

