Assessing Standards:
They Aren't All the Same

Overview:

Participants learn about science standards and the logic behind standards-based reform. They compare four sets of actual physical science content standards for Kindergarten-fourth grade, and learn that the character of each of these sets of standards is very different. The presenter then shares some of the more complex issues involved in standards-based reform, suggesting to participants that it is not as simple as it may at first seem.

Use:

This is an accessible way to introduce some "grey" tones into the all-too-frequent "black and white" depictions that arise in discussions of educational reform issues. The subject *is* complex! This session can stand alone. It is also an excellent activity to present before *What is Alignment and Why Is It Important?*

Key Concepts Addressed from Public Understanding Framework:

Accountability
Standardized Testing

Time Frame: 45 minutes

What Are Standards? (10 minutes)
Analyzing Standards (20 minutes)
Standards-Based Reform—Why It's Not So Simple (15 minutes)

What You Need:

For each group of 3-5 participants:

- o 1 set of "K-4 Physical Science Standards" duplicated onto cardstock
- o folder to hold the set of Standards

For the presenter:

- o 1 each of the following 7 overhead transparencies (masters):
  - 1. "Different Kinds of Standards" transparency
  - 2. "Content Standards" transparency
  - 3. "National/State/District Standards" transparency
  - 4. "Full Range of Knowledge" transparency
  - 5. "Wiggins Types of Knowledge" transparency
  - 6. "Standards-Based Reform" transparency
  - 7. "Why It's Not So Simple" transparency
- o overhead projector
- o extension cord (optional)

Getting Ready:

Before the Day of the Workshop:

1. **Make sets of Standards Cards.** Duplicate one set of 4 Standards Cards onto cardstock for each group of 4-6 participants. One set includes: National Science Education Standards, California State Standards (two-sided), New Standards, Japanese Standards (masters)

2. **Make Overhead Transparencies.** Make the overhead transparencies.

Immediately Before the Workshop:

1. **Set up the room.** Arrange the room so that groups of 4-6 participants can sit at a table together. If you are in a classroom, move desks together to make "tables." Tables should be oriented so that all of the table groups can join a large group discussion, and see what's projected on the overhead.

2. **Set up overhead projector.** Set up overhead projector at the front of the room near where you will stand.

3. **Have overhead transparencies on hand.** Place the 7 overhead transparencies in order next to the overhead projector.

4. **Have sets of Standards Cards on hand.** Have easily accessible, the sets of Standards Cards.

What Are Standards?

1. **Define Standard.** Begin by saying that standards have become central to the idea of accountability. There are different kinds of standards. Show overhead #1:

Different Kinds of Standards

• Content standards define what students should be able to know and do.

• Assessment standards define good assessment practices.

• Professional development standards define good teacher education practices.

2. **Standards Are Created by People.** Explain that standards are created by groups of people, usually including experts and educators. Show overhead #2.

Content Standards
Content standards represent what the group of people that made them believe is important for students to know and be able to do.

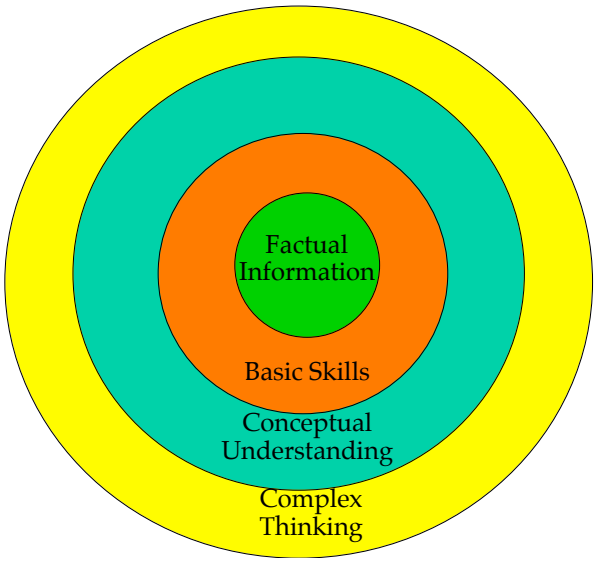
3. **Content Standards exist at Different Levels.** Say that there are National standards, State standards (in all states by Iowa), and that usually there are District standards. Show overhead #3:

There are national standards, state standards, and district standards. District standards usually reflect state and/or national standards.

Sometimes State and District standards are derivative of National standards. Sometimes not. Usually district standards usually reflect state and/or national standards. Mention here what the relationship of your state and district standards are to each other and to the national standards.

4. **Show One Model of Knowledge**. Point out that there are different types of knowledge. Show overhead #4:

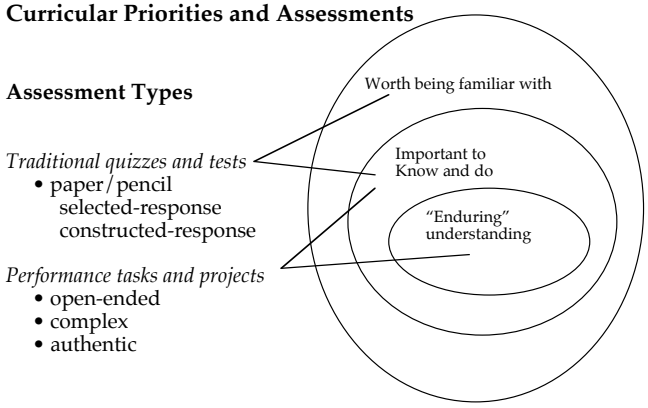
Full Range of Knowledge



This way of looking at knowledge distinguishes between facts, skills, and conceptual knowledge. Give an example about income taxes. Knowing that taxes are due on April 15th is **a fact**. Knowing how to read forms, answer questions, and compute the amount of taxes dues **involves skills**. Understanding that taxes are a primary means by which our society obtains revenues with which to pay for collective services is **conceptual knowledge**. Each kind of knowledge is different, but all are important to successful understanding.

5. **Show a Second Model of Knowledge**. Provide another model of knowledge, proposed by an educator named Grant Wiggins. Show overhead #5:

Wiggins Types of Knowledge



This way of looking at knowledge distinguishes between those things that are worth being familiar with; those things that are important to know and do; and those things that are important for creating an enduring understanding. Ask participants to recall when they were in school and to remember the subjects they learned back then, and which resulted in enduring knowledge. It's not surprising that many of us don't remember lots of what we learned, because most instruction is not geared for creating enduring understanding.

6. **Different Standards Emphasize Different Kinds of Knowledge.** Conclude by saying that there are lots of ways to look at knowledge. Distinguishing the different kinds of knowledge becomes important in examining standards. Different standards emphasize different kinds of knowledge.

Analyzing Standards

1.Comparing Different Standards. Tell the group that you are going to give them the opportunity to compare different samples of standards—from the National Science Education Standards, the California State Standards, New Standards, and the Japanese Standards. All are physical science standards for grades K-4.

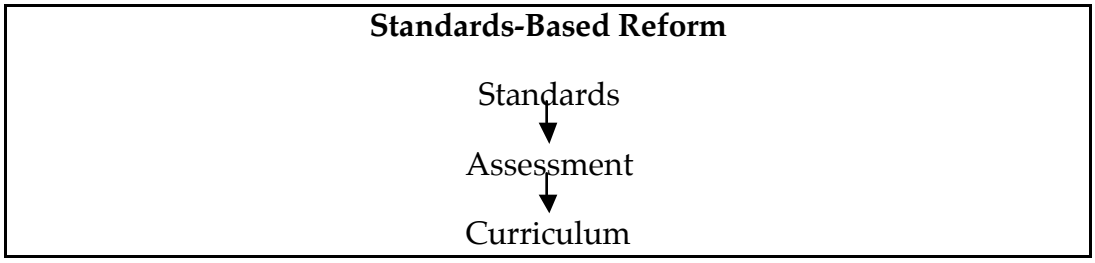
2. Small Group Discussion. Ask participants to work in small groups to read and compare these standards. Tell them to discuss how the standards are the same and how they're different. Suggest they compare the ways each of the standards looks at knowledge (facts, skills, concepts, enduring understanding).

3. Large Group Discussion. After the groups have had about 15 minutes to read and discuss the standards, focus their attention. Ask for them to share their findings about how the standards are the same and how they're different. Ask them to try and characterize the different standards.

4.Conclusion. Conclude by saying that each set of standards has its own character. Experts don't always agree about what's most important for students to know. Highlight the subjectivity of choices that are made in each (about whether to include something or not; about whether to present students with a big picture understanding or a detailed understanding). Not all standards are the same, so not all standards-based reform efforts are the same.

Standards-Based Reform—Why It's Not So Simple

1. **Explain the Logic of Standards-based Reform.** Standards-based reform is when content standards are the driving force for change in the educational system. Show overhead #6:



Explain that for standards-based reform to work, there needs to be quality standards about what children should know. This has been harder than it seems for the community to agree on.

2. Why It's Not So Simple. Explain that in theory, standards-based reform is extremely logical and seems straightforward. Say that you are going to share with them some of the reasons why, in practice, it's not so simple. Show overhead #7:

Why It's Not So Simple
Which standards should be used?
What's the mix of knowledge and reasoning skills should standards be based on?
Which knowledge?
Who chooses the standards?
For which students?
What role should standards play?
Do all students have an equal opportunity to learn?

3. Which standards? Does a school district rely on national standards, state standards, or district standards? This would be easier if all of these were related. In the case of some states, such as California and Virginia, the state standards are significantly different from the national standards.

4. Mix of knowledge and reasoning. Should standards be based on mostly things that must be memorized or mostly things that require reasoning? What kinds of knowledge are emphasized? Currently some sets of standards emphasize a huge number of disconnected facts and skills.

Critics believe this doesn't live up to the vision of what standards were supposed to create—an intellectually demanding level of knowledge. Should there be more knowledge or deeper knowledge? This is a major difference in different sets of standards.

5. Which knowledge? Should students know the state capitals? About biotechnology? About why earthquakes occur? About the Periodic Table? The amount of knowledge there is in any one subject area is so great and increasing so rapidly that it is necessary to pick and choose what's important.

Most standards include much more than a teacher could ever teach in a year, so even schools and school districts who embrace standards must decide what subset of those standards to include.

6. **Who chooses the standards?** This is a highly political question.

   Deborah Meier (who wrote the book, *Will Standards Save Public Education*) believes that standards should only be set by a group of adults who know the particular students for whom these standards will be used—teachers in a school, the students' parents.

   Susan Ohanian (who wrote the book, *One Size Fits Few*) believes that children don't fit into standard categories and only a child's individual teachers can know what's right for that child.

   Critics argue that local control introduces a potential for wrong decisions resulting in low quality and wildly diverse standards—and invalidates standardized tests as a measure.

7. **For which students?** Should standards be written so they are attainable by all students? Or should they be challenging so they are attainable by just the best students? This is what's referred to as the "floor" versus the "ceiling." The assumptions matter a lot. The controversy has raged under the guise of low standards vs. elitist standards.

8. **What role should standards play?** Should standards be advisory to a school, required by a school, or should they drive academic advancement? This boils down to whether anyone is accountable for standards, and if so, whether it should be schools, teachers, or the student him- or herself. "High stakes" standards are what's referred to when a school's funding is dependent on how its students perform on standardized tests and/or when a student can only advance to the next grade when s/he has demonstrated knowledge of the standards.

9. **Do all students have an equal opportunity to learn?** The process of standards-based reform has moved so fast that few teachers and schools have been able to create a curriculum that's well aligned to the standards. There's been neither the time nor the professional development provided to help transform and align curriculum to standards. Nor has their been the funding for such a major change. This has become a key issue in standards-based reform. Many believe that the failure to invest the time and resources in teacher professional development and curriculum planning has created a fatal flaw in the process. The result, they say, is that not all students have an equal opportunity to learn the knowledge in the standards.

10. **Conclusion.** Conclude by saying that the process of attempting to agree on standards has been a highly political process. Especially given our nation's strong culture of autonomy and democracy, the standards battle will continue to be a hard and complex one. This is in sharp contrast to many other countries, who set standards relatively easily, without as much controversy. Standards-based reform could be an enlightened path or a regressive path, depending on what one thinks of the quality of the standards that are driving the process.

Different Kinds of Standards

- Content standards define what students should be able to know and do.

- Assessment standards define good assessment practices.

- Professional development standards define good teacher education practices.

Overhead #1

Content Standards

Content standards represent what the group of people that made them believe is important for students to know and be able to do.

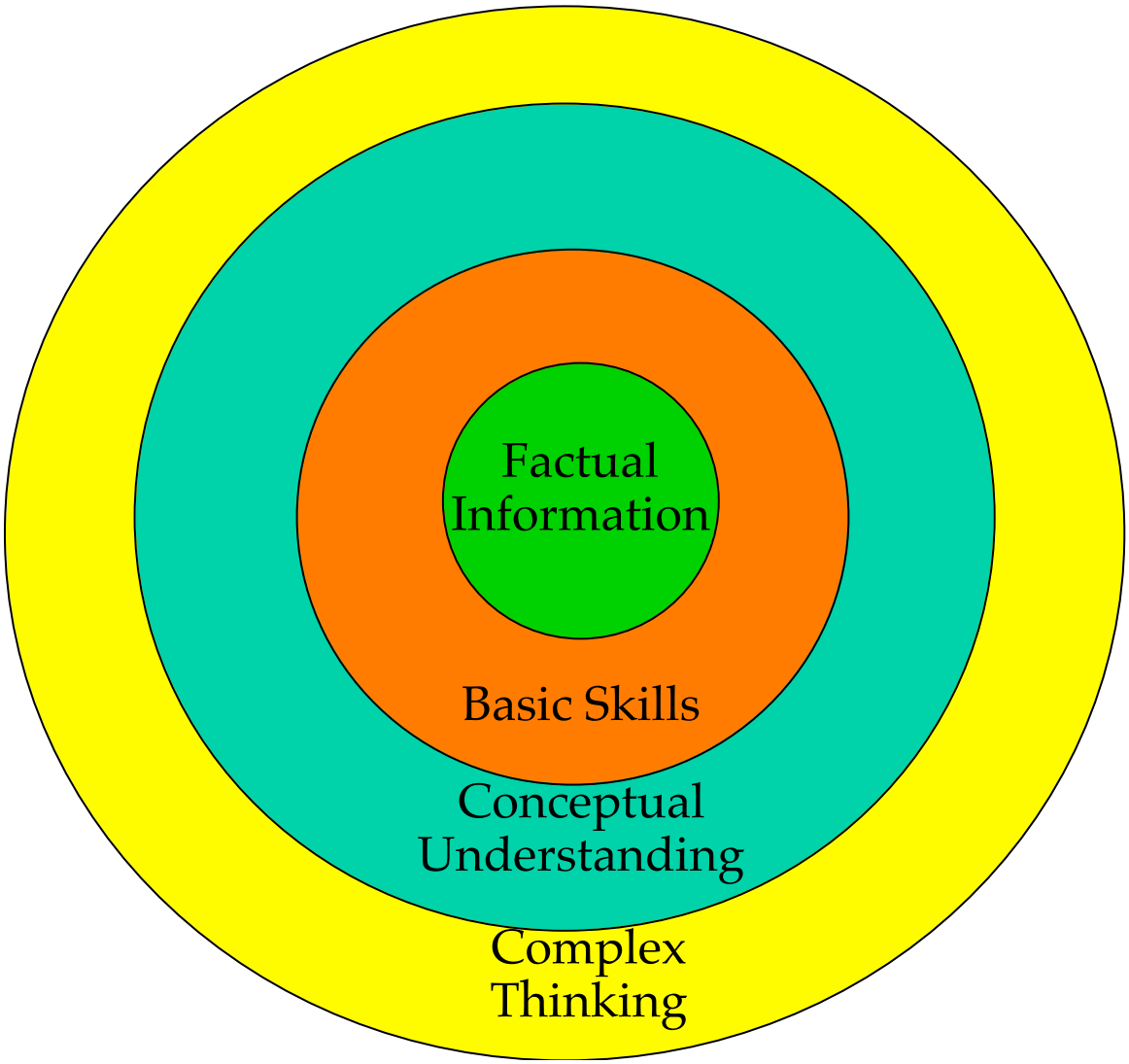
Overhead #2

There are national standards, state standards, and district standards.

District standards usually reflect state and/or national standards.

Overhead #3

Full Range of Knowledge



Curricular Priorities and Assessments

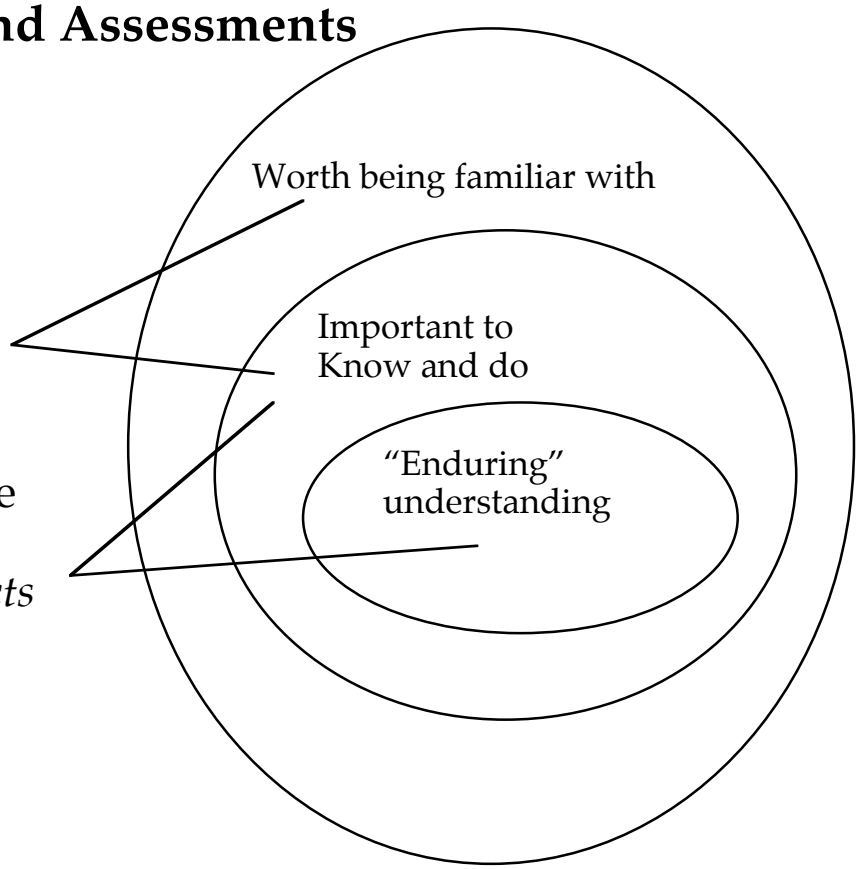
Assessment Types

Traditional quizzes and tests

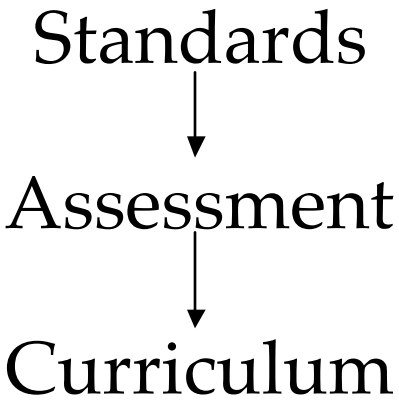
- paper / pencil
  selected-response
  constructed-response

Performance tasks and projects

- open-ended
- complex
- authentic



Standards-Based Reform



Overhead #6

Why It's Not So Simple

Which standards should be used?

What's the mix of knowledge and reasoning skills should standards be based on?

Which knowledge?

Who chooses the standards?

For which students?

What role should standards play?

Do all students have an equal opportunity to learn?

Overhead #7

California State Standards
Grades K-4 (accountable by grade)
Physical Science

Kindergarten

1. Properties of materials can be observed, measured, and predicted. As a basis for understanding this concept:

a. Students know objects can be described in terms of the materials they are made of and their physical properties (e.g., color, size, shape, weight, texture, flexibility, attraction to magnets, floating, sinking)

b. Students know water can be a liquid or a solid and can be made to change back and forth from one form to the other.

c. Students know water left in an open container evaporates (goes into the air) but water in a closed container does not.

1st Grade

1. **Materials come in different forms (states), including solids, liquids and gases.** As a basis for understanding this concept:
   a. Students know solids, liquids, and gases have different properties.
   b. Students know the properties of substances can change when the substances are mixed, cooled, or heated.

2nd Grade

1. The motion of objects can be observed and measured. As a basis for understanding this concept:

a. Students know the position of an object can be described by locating it in relation to another object or to the background.

b. Students know an object's motion can be described by recording the change in position of the object over time.

c. Students know the way to change how something is moving is by giving it a push or a pull. The size of the change is related to the strength, or the amount of force, of the push or pull.

d. Students know tools and machines are used to apply pushes and pulls (forces) to make things move.

e. Students know objects fall to the ground unless something holds them up.

f. Students know magnets can be used to make some objects move without being touched.

g. Students know sound is made by vibrating objects and can be described by its pitch and volume.

3rd Grade

1. Energy and matter have multiple forms and can be changed from one form to another. As a basis for understanding this concept:

- Students know energy comes form the Sun to Earth in the form of light.
- Students know sources of stored energy take many forms, such as food, fuel, and batteries
- Students know machines and living things convert stored energy to motion and heat.

3rd Grade

1. **Energy and matter have multiple forms and can be changed from one form to another. (continued)**

- Students know energy can be carried from one place to another by waves, such as water waves and sound waves, by electric current, and by moving objects.
- Students know matter has three forms: solid, liquid and gas.
- Students know evaporation and melting are changes that occur when objects are heated.
- Students know two or more substances are combined, a new substance may be formed that can have properties that are different than those of the original materials.
- Students know all matter is made of small particles, called atoms that are too small to see with our eyes.
- Students know people once thought that earth, wind, fire, and water were the basic elements that made up all matter. Science experiments show that there are more than 100 different types of atoms, which are presented on the periodic table of the elements.

2. Light has a source and travels in a direction. As a basis for understanding this concept:

4. Students know sunlight can be blocked to create shadows.
5. Students know light is reflected from mirrors and other surfaces.
6. Students know the color of light striking an object affects the way the object is seen.
7. Students know an object is seen when light traveling from the object enters the eye.

4th Grade

1. Electricity and magnetism are related effects that have many useful applications in everyday life. As a basis for understanding this concept:

a. Students know how to design and build simple series and parallel circuits by using components such as wires, batteries and bulbs.
b. Students know how to build a simple compass and use it to detect magnetic effects, including Earth's magnetic field.
c. Students know electric currents produce magnetic fields and know how to build a simple electromagnet.
d. Students know the role of electromagnets in the construction of electric motors, electric generators, and simple devices, such as doorbells and earphones.
e. Students know electrically charged objects attract and repel each other.
f. Students know that magnets have 2 poles (north and south) and that like poles repel each other while unlike poles attract each other.
g. Students know electrical energy can be converted to heat, light, and motion.

National Science Education Standards
Grades K-4 (accountable by the end of 4th grade)

Physical Sciences

Content Standard B: As a result of the activities in grades K-4, all students should develop an understanding of:

- **Properties of objects and materials.**

—Objects have many observable properties, including size, weight, shape, color, temperature, and the ability to reach with other substances. Those properties can be measured using tools, such as rulers, balances, and thermometers.

—Objects are made of one or more materials, such as paper, wood, and metal. Objects can be described by the properties of the materials from which they are made, and those properties can be used to separate or sort a group of objects or materials.

—Materials can exist in different states—solid, liquid, and gas. Some common materials, such as water, can be changed form one state to another by heating or cooling.

- **Position and motion of objects.**

—The position of an object can be described by locating it relative to another object or the background.

—An object's motion can be described by tracing and measuring its position over time.

—The position and motion of objects can be changed by pushing or pulling. The size of the change is related to the strength of the push or pull.

—Sound is produced by vibrating objects. The pitch of the sound can be varied by changing the rate of vibrations.

- **Light, heat, electricity, and magnetism**

—Light travels in a straight line until it strikes an object. Light can be reflected by a mirror, refracted by a lens, or absorbed by the object.

—Heat can be produced in many ways, such as burning, rubbing, or mixing one substance with another. Heat can move from one object to another by conduction.

—Electricity in circuits requires a complete loop through which an electrical current can pass.

—Magnets attract and repel each other and certain kinds of other materials.

New Standards
The National Center on Education and the Economy
Elementary School Science Standards
(approximately end of 4th grade)

S1—Physical Science Concepts

The student demonstrates conceptual understanding by using a concept accurately to explain observations and make predictions and by representing the concept in multiple ways (through words, diagrams, graphs or charts, as appropriate). Both aspects of understanding—explaining and representing—are required to meet this standard. The student produces evidence that demonstrates understanding of:

S1a Properties of objects and materials, such as similarities and differences in the size, weight, and color of objects; the ability of materials to react with other substances; and different states of materials.

S1b Position and motion of objects, such as how the motion of an object can be described by tracing and measuring its position over time; and how sound is produced by vibrating objects.

S1c Light, heat, electricity, and magnetism, such as the variation of heat and temperature; how light travels in a straight line until it strikes an object or how electrical circuits work.

Japanese Standards
The Japanese Ministry of Education
Elementary School Science Standards (K- 4th grade)

Physical Science Concepts

Students are offered opportunities for experimentation and scientific observation. The aim is to strengthen their capacity to study science, kindle a passion for science, and enthuse them to explore and comprehend nature more deeply.

Grade 3:

B1: The properties of air and water

B2: The properties of substances

Grade 4:

B1: The difference of the weight of materials

B2: The functions of electricity and light

