LIVE INTERACTIVE LEARNING @ YOUR DESKTOP

NSTA Web Seminar:

Intro to the Atlas of Science Literacy

Tuesday, November 18, 2008

Using Atlas of Science Literacy

Project 2061
AAAS

Ted Willard

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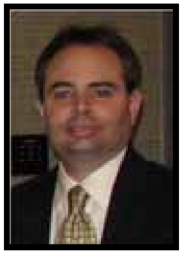

Familiarity with the Atlas

How familiar are you with the Atlas of Science Literacy?

A. This is the first time I have heard of it.
B. I've heard of it, but never seen it.
C. I've seen it, but I don't own it
D. I own it, but I don't know how to use it.
E. I own it and use it.

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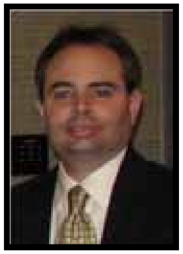

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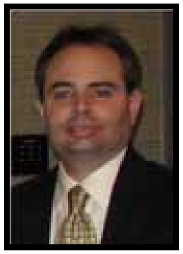

Access to the Atlas

How familiar are you with the Atlas of Science Literacy?

A. I have a copy of Atlas 1 and Atlas 2 with me right now.
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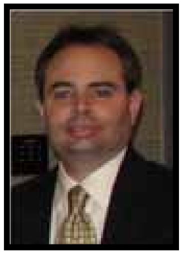

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The Need for Change

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The Need for Change

- Curricula often focus on quickly forgotten details and terms rather than the understanding of major concepts and processes.
- Helping students achieve a clear understanding of ideas is extremely difficult.
- Students (even the best and the brightest) understand less than we think they do.

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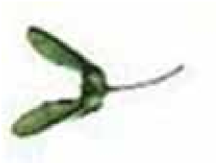
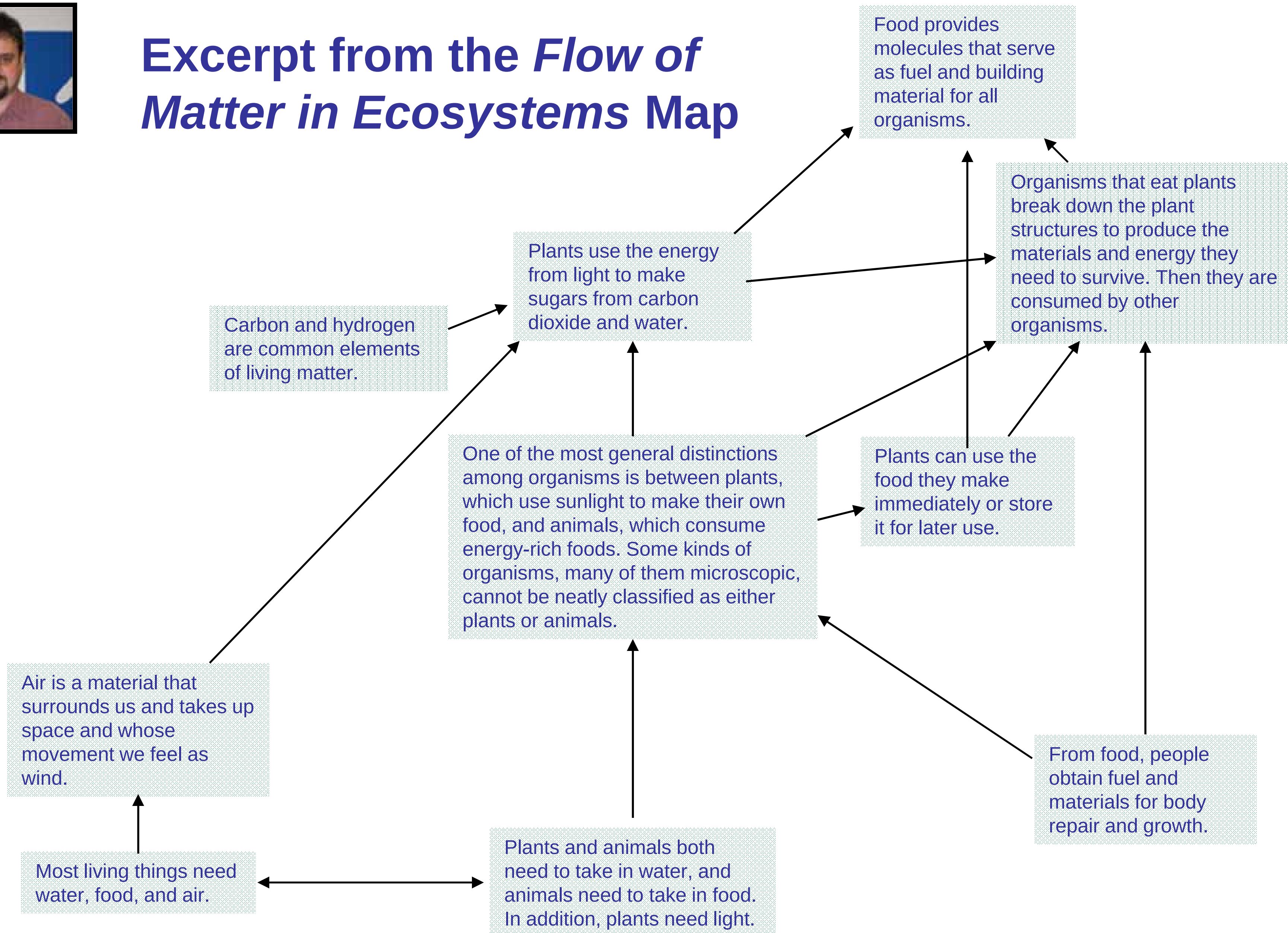
For Example…

Consider a Seed and a Log



- Under the right conditions, a maple seed can grow into a maple tree.
- But a maple tree is much bigger and more massive than a maple seed.
- How would your students explain where all of the extra material a maple tree has comes from?

Excerpt from the *Flow of Matter in Ecosystems* Map



A Private Universe

- Look at the benchmarks on the strand map.
- Decide which ones are of particular importance in answering the question.
- While watching the film, think about what level of understanding did the students' responses demonstrate.

Special thanks to the Science Media Group
at the Harvard Smithsonian Center for Astrophysics

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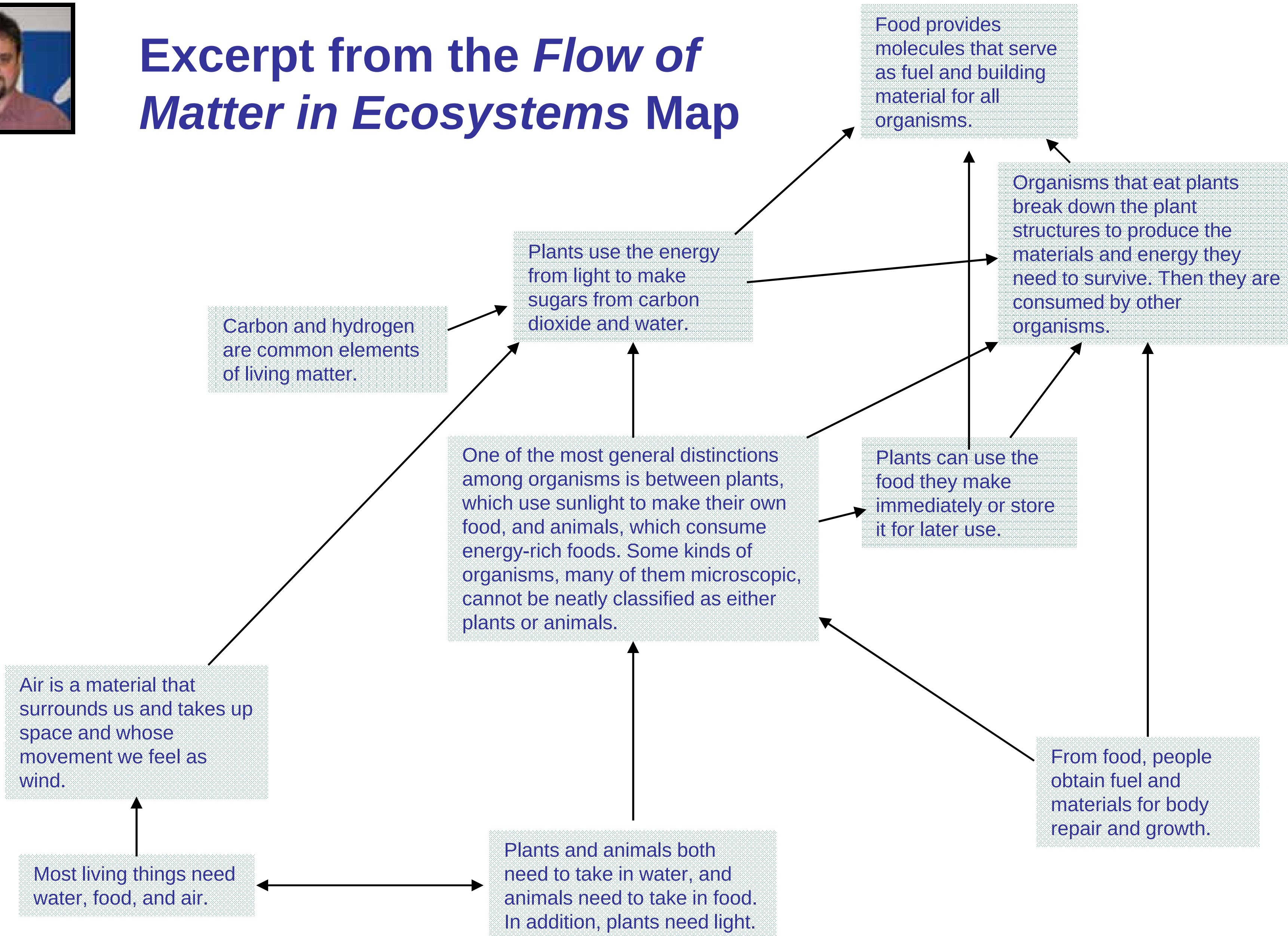
Excerpt from the *Flow of Matter in Ecosystems* Map

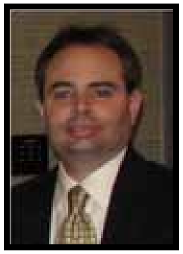


Probing for Understanding

- How do the responses of the Harvard & MIT graduates differ from those of the 4th graders?
- Do the Harvard & MIT graduates seem to have a more sophisticated understanding?
- What ideas have the graduates missed?

Points to Consider

- Science education is not working for most students, even in the best schools.
- Science educators need a coherent set of K-12 learning goals.
- A thorough understanding of science literacy and learning goals is essential for effective teaching and learning.



Let’s Pause for Two Questions

About
Project 2061

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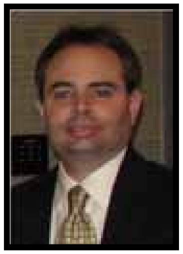
About Project 2061

- The **American Association for the Advancement of Science** was founded in 1848. It is the world's largest general science organization and publisher of the peer-reviewed journal *Science.*
- In 1985 AAAS launched a long-term effort to reform science, mathematics, and technology education for the 21st century,

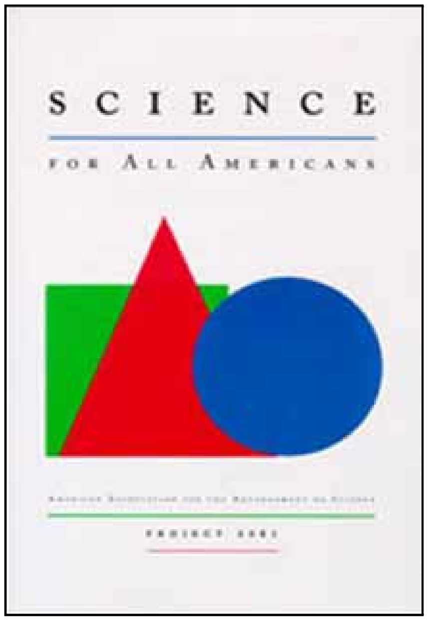
- Since Halley's comet was visible in the skies when the project was founded, the name Project 2061 was chosen to mark the year that comet will return.

Project 2061 believes...

- Science literacy is important for **<u>all</u>** students, not only those electing science careers.
- "Science" includes natural science, social science, mathematics, and technology.
- There are no quick fixes.
- Curriculum should cover less material but at greater depth.
- Reform must be structured around powerful, meaningful goals.



Science for All Americans



- Presents the knowledge and skills that make up science literacy goals

I own a copy.	I don’t own a copy.

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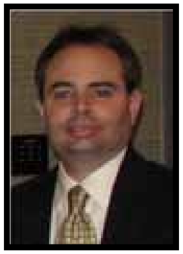
Table of Contents

Paragraph from *SFAA* (page 43)

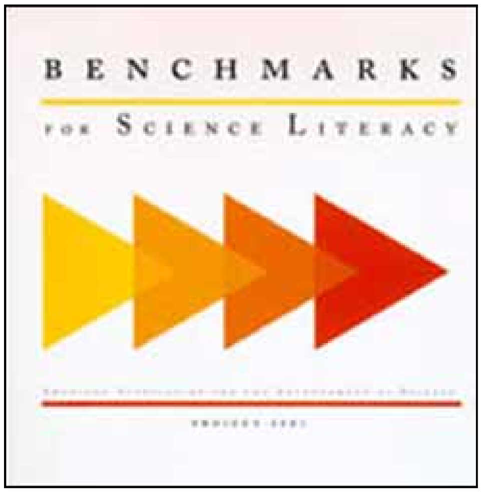
Chapter 4—The Physical Setting

Section B—The Earth

- The cycling of water in and out of the atmosphere plays an important part in determining climatic patterns—evaporating from the surface, rising and cooling, condensing into clouds and then into snow or rain, and falling again to the surface, where it collects in rivers, lakes, and porous layers of rock. There are also large areas on the earth's surface covered by thick ice (such as Antarctica), which interacts with the atmosphere and oceans in affecting worldwide variations in climate.



Benchmarks for Science Literacy



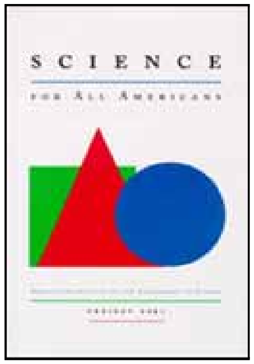
- Provides a set of learning goals for the ends of grades 2, 5, 8, and 12

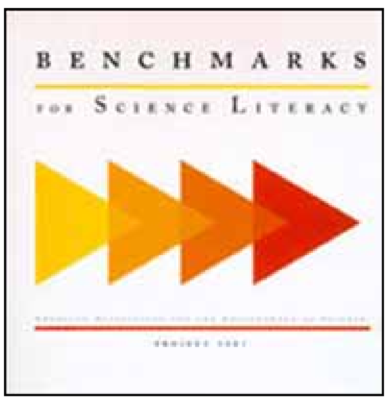
I own a copy.	I don’t own a copy.

Benchmarks Development Team

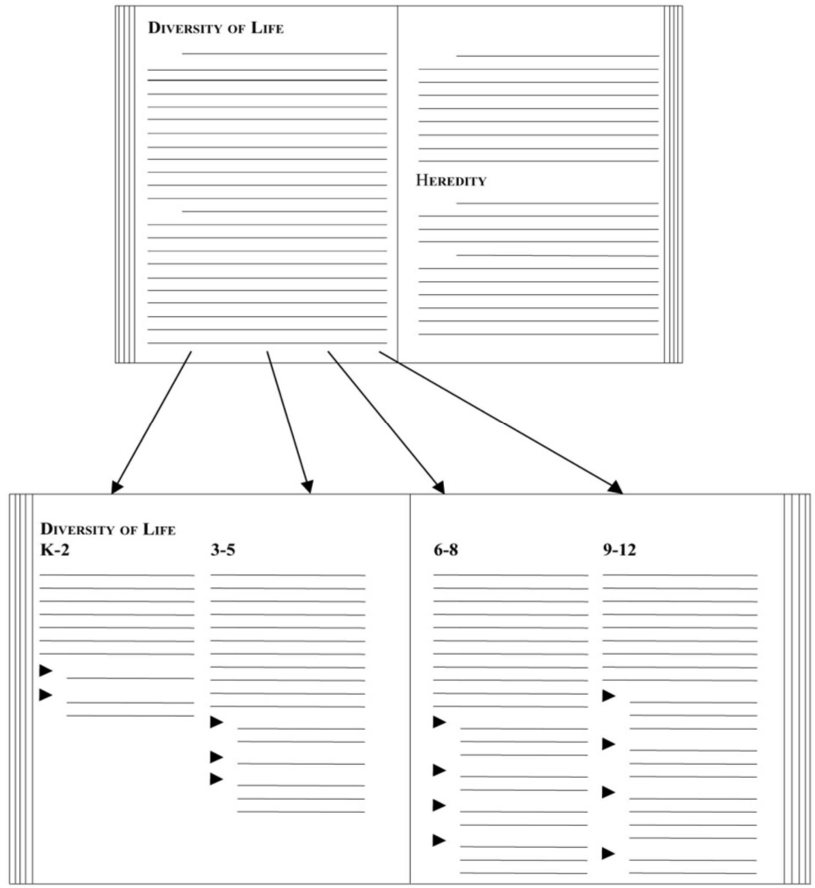
- 4 years
  - 6 teams
    - 25 teachers per team
      - One day (+) each month
        - Six-week Summer Institutes

Benchmarks is based on *SFAA*





SCIENCE FOR ALL AMERICANS



BENCHMARKS FOR SCIENCE LITERACY

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Benchmarks from *BSL* (pages 67-70)

K-2 Water left in an open container disappears, but water in a closed container does not disappear.

3-5 When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets of water.

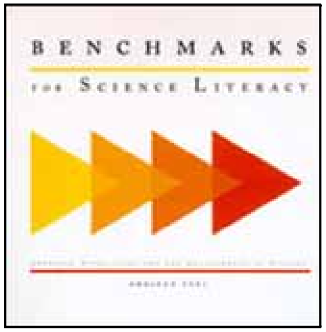
6-8 The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns. Water evaporates from the surface of the earth, rises and cools, condenses into rain or snow, and falls again to the surface. The water falling on land collects in rivers and lakes, soil, and porous layers of rock, and much of it flows back into the ocean.

9-12 Life is adapted to conditions on the earth, including the force of gravity that enables the planet to retain an adequate atmosphere, and an intensity of radiation from the sun that allows water to cycle between liquid and vapor.

Atlas of Science Literacy

- Illustrates the relationships between individual learning goals and shows the growth-of-understanding of ideas

Most Boxes are Based on Benchmarks



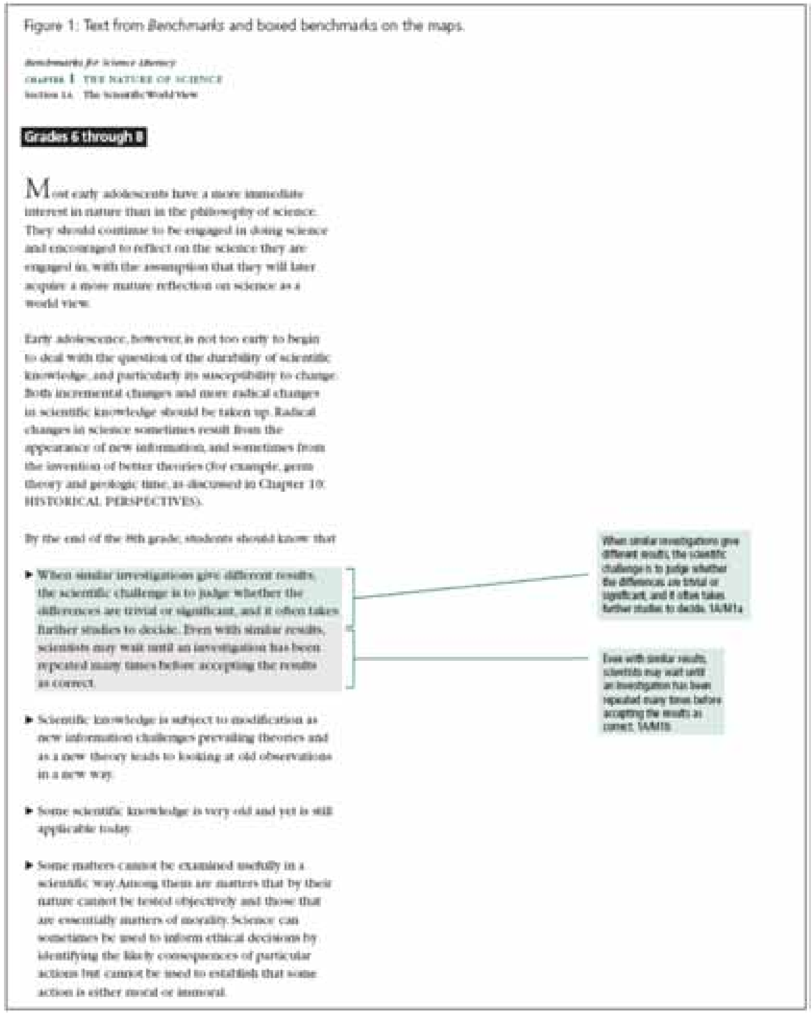


Figure 1: Text from *Benchmarks* and boxed benchmarks on the maps.

Benchmarks for Science Literacy
CHAPTER 1 THE NATURE OF SCIENCE
Section 1A The Scientific World View

Grades 6 through 8

Most early adolescents have a more immediate interest in nature than in the philosophy of science. They should continue to be engaged in doing science and encouraged to reflect on the science they are engaged in, with the assumption that they will later acquire a more mature reflection on science as a world view.

Early adolescence, however, is not too early to begin to deal with the question of the durability of scientific knowledge, and particularly its susceptibility to change. Both incremental changes and more radical changes in scientific knowledge should be taken up. Radical changes in science sometimes result from the appearance of new information, and sometimes from the invention of better theories (for example, germ theory and geologic time, as discussed in Chapter 10: HISTORICAL PERSPECTIVES).

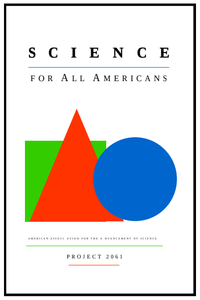
By the end of the 8th grade, students should know that

- When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, and it often takes further studies to decide. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as correct.
- Scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.
- Some scientific knowledge is very old and yet is still applicable today.
- Some matters cannot be examined usefully in a scientific way. Among them are matters that by their nature cannot be tested objectively and those that are essentially matters of morality. Science can sometimes be used to inform ethical decisions by identifying the likely consequences of particular actions but cannot be used to establish that some action is either moral or immoral.

When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, and it often takes further studies to decide. 1A/M1a

Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as correct. 1A/M1b

But some come from SFAA



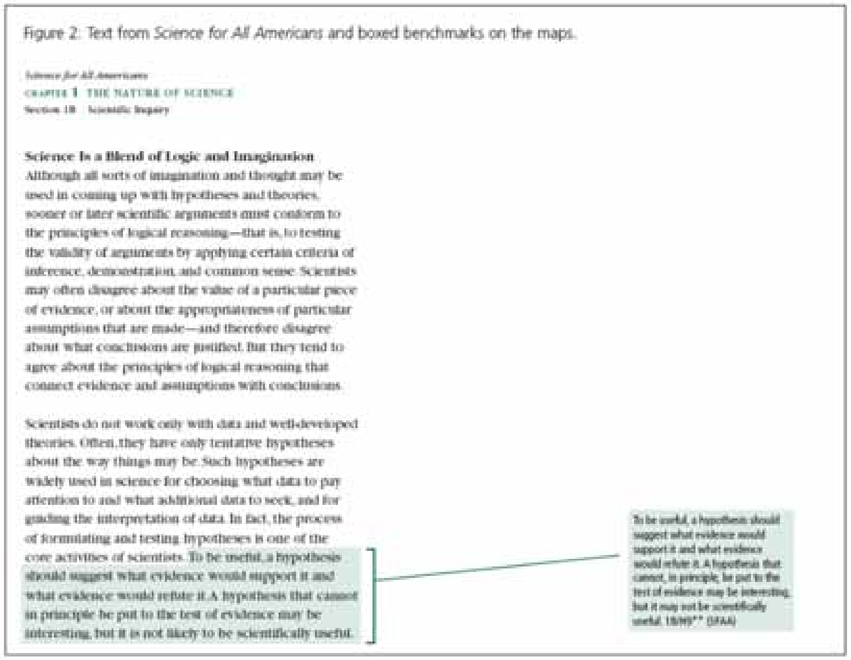


Figure 2: Text from *Science for All Americans* and boxed benchmarks on the maps.

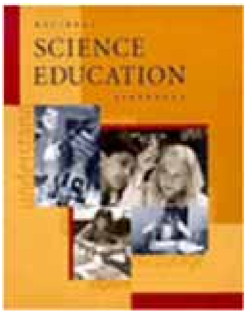
Science for All Americans
CHAPTER 1 THE NATURE OF SCIENCE
Section 1B Scientific Inquiry

Science Is a Blend of Logic and Imagination
Although all sorts of imagination and thought may be used in coming up with hypotheses and theories, sooner or later scientific arguments must conform to the principles of logical reasoning—that is, to testing the validity of arguments by applying certain criteria of inference, demonstration, and common sense. Scientists may often disagree about the value of a particular piece of evidence, or about the appropriateness of particular assumptions that are made—and therefore disagree about what conclusions are justified. But they tend to agree about the principles of logical reasoning that connect evidence and assumptions with conclusions.

Scientists do not work only with data and well-developed theories. Often, they have only tentative hypotheses about the way things may be. Such hypotheses are widely used in science for choosing what data to pay attention to and what additional data to seek, and for guiding the interpretation of data. In fact, the process of formulating and testing hypotheses is one of the core activities of scientists. To be useful, a hypothesis should suggest what evidence would support it and what evidence would refute it. A hypothesis that cannot in principle be put to the test of evidence may be interesting, but it is not likely to be scientifically useful.

To be useful, a hypothesis should suggest what evidence would support it and what evidence would refute it. A hypothesis that cannot, in principle, be put to the test of evidence may be interesting, but it may not be scientifically useful. 1B/M9** (SFAA)

and some come from NSES



- The atmosphere is a mixture of nitrogen, oxygen, and trace gases that include water vapor. The atmosphere has different properties at different elevations.
- Clouds, formed by the condensation of water vapor, affect weather and climate.
- Global patterns of atmospheric movement influence local weather. Oceans have a major effect on climate, because water in the oceans holds a large amount of heat.
- Living organisms have played many roles in the earth system, including affecting the composition of the atmosphere, producing some types of rocks, and contributing to the weathering of rocks.

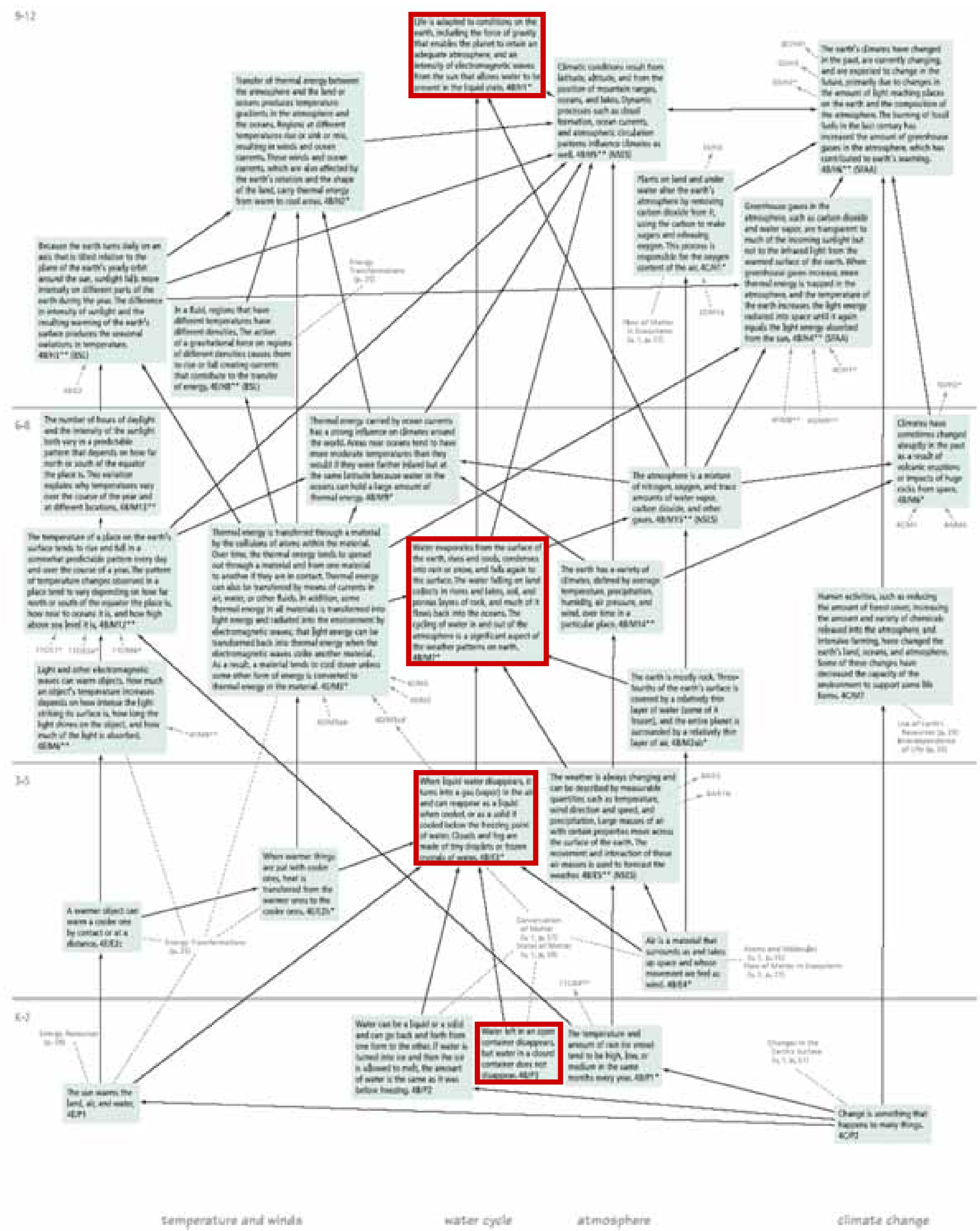
The atmosphere is a mixture of nitrogen, oxygen, and trace amounts of water vapor, carbon dioxide, and other gases. 4B/M15** (NSES)

EARTH'S HISTORY

- The earth processes we see today, including erosion, movement of lithospheric plates, and changes in atmospheric composition, are similar to those that occurred in the past. earth history is also influenced by occasional catastrophes, such as the impact of an asteroid or comet.
- Fossils provide important evidence of how life and environmental conditions have changed.

See Content Standard C (grades 5-8)

Weather and Climate



(p. 21)

Map Commentary

(p. 20)

The earth has a variety of climatic patterns, which consist of different conditions of temperature, precipitation, humidity, wind, air pressure, and other atmospheric phenomena. These result from a variety of factors. Climate and changes in climate have influenced in the past and will continue to influence what kinds of life forms are able to exist. Understanding the basic principles that contribute to maintaining and causing changes in weather and climate increases our ability to forecast and moderate the effects of weather and to make informed decisions about human activities that may contribute to climate change.

The map is organized around four strands—*temperature and winds, water cycle, atmosphere,* and *climate change.* The progression of understanding begins in the elementary grades with observations about heat transfer, changes in water from one state to another, and changes in weather over the course of a day and over the course of seasons. By middle school, the focus is on the water cycle, patterns of change in temperature, and the notion of climate change. In high school, seasons and winds and the water cycle are related to gravity and the earth's rotation, and climate change is related to natural causes and human activities.

Benchmarks in this map about temperature and winds draw on ideas about heat transfer and transformation in the **ENERGY TRANSFORMATIONS** map. Benchmarks in the *climate change* strand are also related to the **SCIENCE AND SOCIETY** map. The widespread use of climate models to improve our understanding of the earth's climate system and climate change suggests a connection to benchmarks in the **MODELS** map as well.

NOTES

The left-hand side of the *temperature and winds* strand presents a progression of understanding of seasons. The explanation of the seasons in terms of the tilt of the earth requires students to engage in fairly complex spatial reasoning. For this reason, although the idea is introduced at the 6-8 grade level in *Benchmarks*, the map places it (4B/H3) at the 9-12 level.

Benchmarks related to the heating of materials and the transfer of thermal energy lay the conceptual groundwork for understanding solar heating, global circulation, seasonal weather patterns and climate, and the effect of greenhouse gases. To understand how thermal energy moves in both oceanic and atmospheric systems, students need to know that convective currents are an essential mechanism that aids in that movement. In middle school, understanding of convection currents is linked to experiences with relevant phenomena. Understanding convection in terms of gravity, buoyant forces, and pressure is not expected until high school. It is not necessary for students to have a molecular comprehension of thermal energy to be able to understand atmospheric and oceanic circulation patterns and their role in climate.

Several lines of conceptual development converge in the new 9-12 benchmark that begins "Climatic conditions result from…." These include an understanding of temperature patterns over the earth, atmospheric and oceanic circulation patterns, and the water cycle. A double-headed arrow between this benchmark and another new benchmark (4B/H6) on climate change indicates that they are closely related but that neither is conceptually dependent on the other.

RESEARCH IN *BENCHMARKS*

Students of all ages (including college students and adults) have difficulty understanding what causes the seasons. Students may not be able to understand explanations of the seasons before they reasonably understand the relative size, motion, and distance of the sun and the earth (Sadler, 1987; Vosniadou, 1991). Many students before and after instruction in earth science think that winter is colder than summer because the earth is farther from the sun in winter (Atwood & Atwood, 1996; Dove, 1998; Philips, 1991; Sadler, 1998). This idea is often related to the belief that the earth orbits the sun in an elongated elliptical path (Galili & Lavrik, 1998; Sadler, 1998). Other students, especially after instruction, think that the distance between the northern hemisphere and the sun changes because the earth leans toward the sun in the summer and away from the sun in winter (Galili & Lavrik, 1998; Sadler, 1998). Students' ideas about how light travels and about the earth-sun relationship, including the shape of the earth's orbit, the period of the earth's revolution around the sun, and the period of the earth's rotation around its axis, may interfere with students' understanding of the seasons (Galili & Lavrik, 1998; Salierno, Edelson, & Sherin, 2005). For example, some students believe that the side of the sun not facing the earth experiences winter, indicating a confusion between the daily rotation of the earth and its yearly revolution around the sun (Salierno, Edelson, & Sherin, 2005).

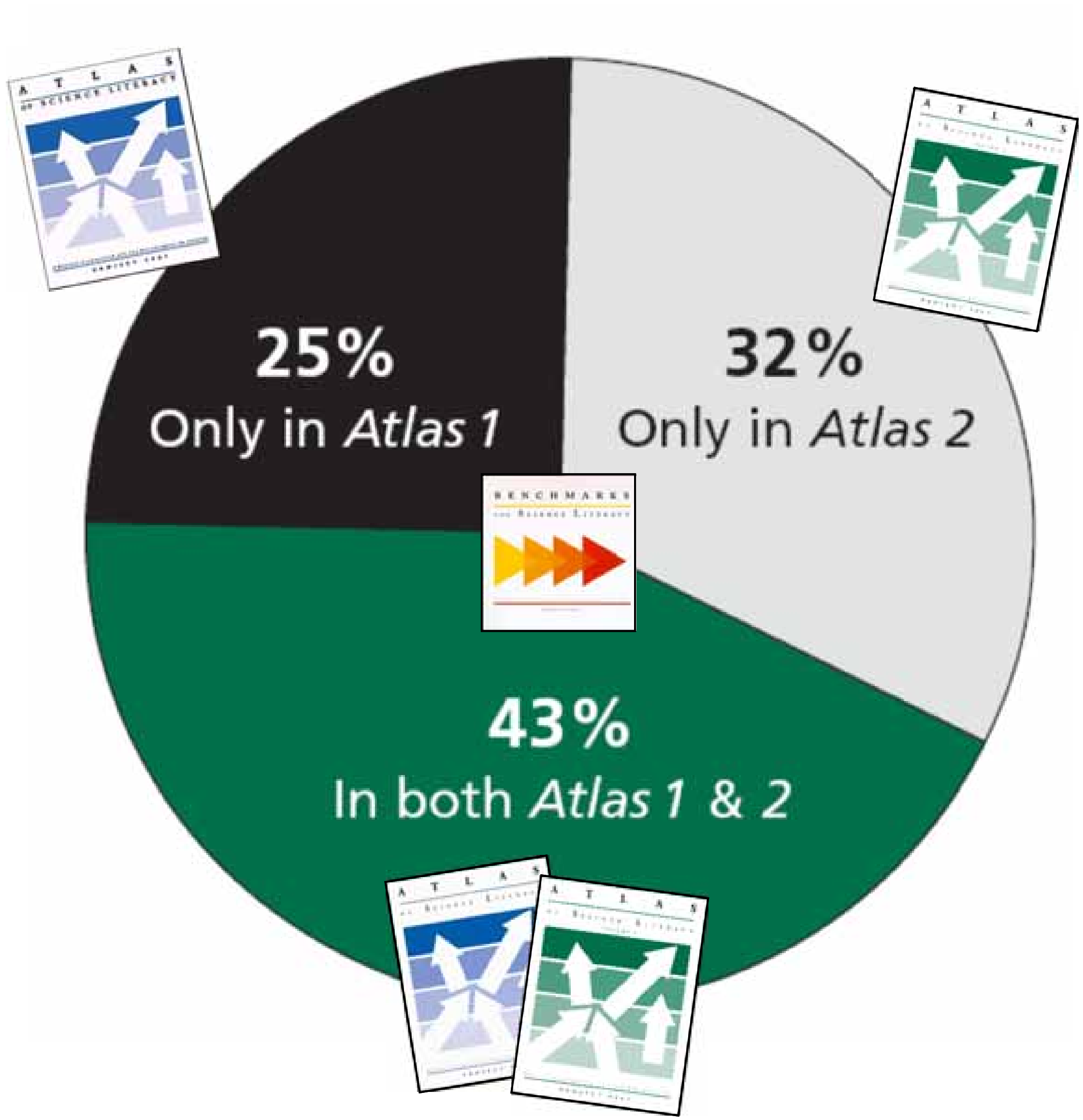
Although upper elementary students may identify air as existing even in static situations and recognize that it takes space, recognizing that air has weight may be challenging even for high-school students (Sere, 1985; Driver et al., 1994a; Krnel, Watson, & Glazar, 1998). Students of all ages (including college students) may believe that air exerts force or pressure only when it is moving and only downwards (Driver et al., 1994a; Sere, 1985; Henriques, 2002; Nelson, Aron, & Francek, 1992). Only a few middle-school students use the idea of pressure differences between regions of the atmosphere to account for wind; instead, they may account for winds in terms of visible moving objects or the movement of the earth (Driver et al., 1994a).

Before students understand that water is converted to an invisible form, they may initially believe that when water evaporates it ceases to exist, or that it changes location but remains a liquid, or that it is transformed into some other perceptible form (fog, steam, droplets, etc.) (Bar, 1989; Russell, Harlen, & Watt, 1989; Russell & Watt, 1990; Krnel, Watson, & Glazar, 1998). With special instruction, some students in 5th grade may be able to identify the air as the final location of evaporating water (Russell & Watt, 1990), but they must first accept air as a permanent substance (Bar, 1989). For many students, difficulty understanding the existence of water vapor in the atmosphere persists in middle school years (Lee et al., 1993; Johnson, 1998). Students can understand rainfall in terms of gravity once they attribute weight to little drops of water (typically in upper elementary grades), but the mechanism through which condensation occurs may not be understood until high school (Bar, 1989).

Students of all ages may confuse the ozone layer with the greenhouse effect, and may have a tendency to imagine that all environmentally friendly actions help to solve all environmental problems (for example, that the use of unleaded petrol reduces the risk of global warming) (Andersson & Wallin, 2000; Koulaidis & Christidou, 1998; Meadows & Wiesenmayer, 1999; Rye, Rubba, & Wiesenmayer, 1997). Students have difficulty linking relevant elements of knowledge when explaining the greenhouse effect and may confuse the natural greenhouse effect with the enhancement of that effect (Andersson & Wallin, 2000).

See **ENERGY RESOURCES** and **ENERGY TRANSFORMATIONS** for additional research.

Distribution of Benchmarks



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4 The Physical Setting

- **Solar System** (4A)
- **Stars** (4A)
- **Galaxies and the Universe** (4A)
- **Changes in the Earth's Surface** (4C)
- **Plate Tectonics** (4C)
- **Atoms and Molecules** (4D)
- **Conservation of Matter** (4D)
- **States of Matter** (4D)
- **Chemical Reactions** (4D)
- **Laws of Motion** (4F)
- **Waves** (4F)
- **Gravity** (4G)

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NSTA WEB SEMINARS

4 The Physical Setting

- **Solar System** (4A)
- **Stars** (4A)
- **Galaxies and the Universe** (4A)
- **Weather and Climate** (4B)
- **Use of Earth's Resources** (4B)
- **Changes in the Earth's Surface** (4C)
- **Plate Tectonics** (4C)
- **Atoms and Molecules** (4D)
- **Conservation of Matter** (4D)
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- **Chemical Reactions** (4D)
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- **Waves** (4F)
- **Gravity** (4G)
- **Electricity and Magnetism** (4G)

Benchmarks Online Updated

Since we have revised some of the benchmarks, we have released an updated version of *Benchmarks Online*.

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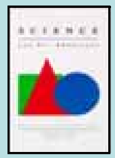
Supporting the Goals

Curriculum

Instruction



Literacy Goals

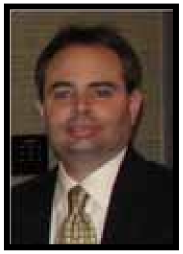
Learning Goals

Connections

Materials Development

Teacher Preparation

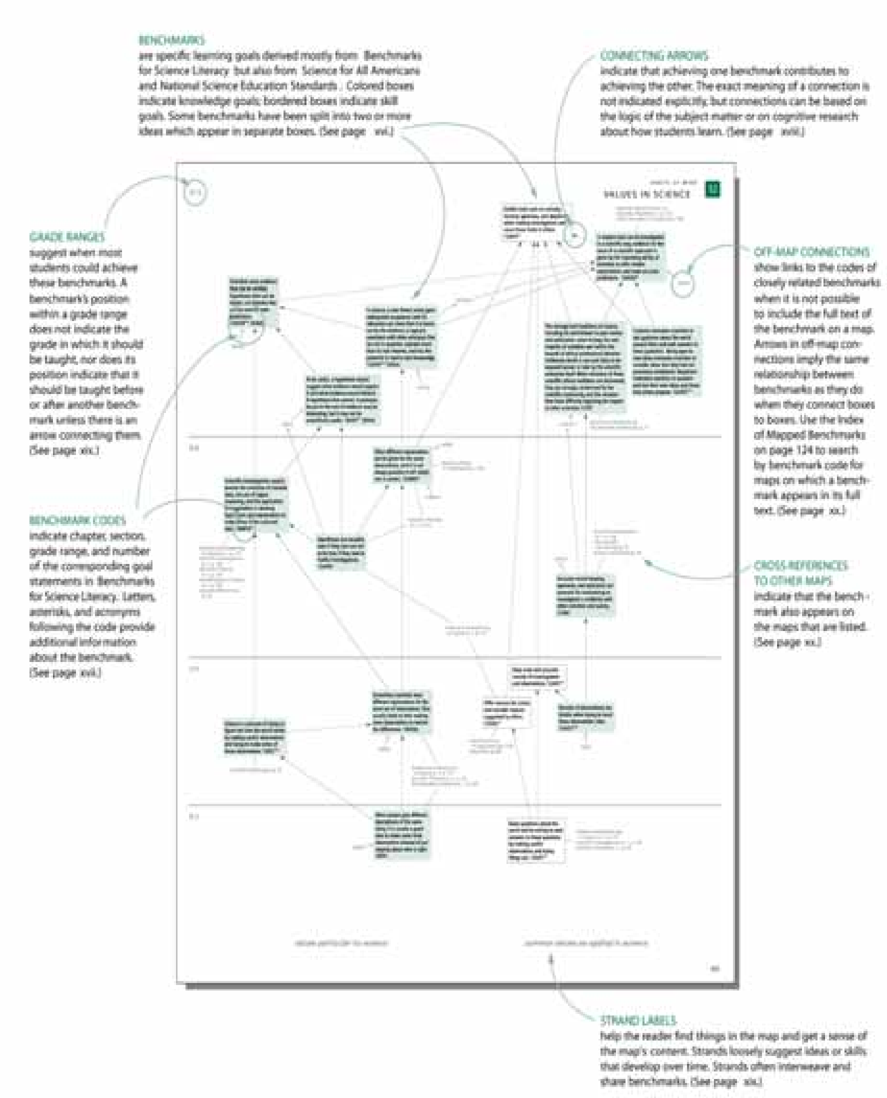
Assessment



Let’s Pause for Two Questions

Boxes on Maps

Map Key

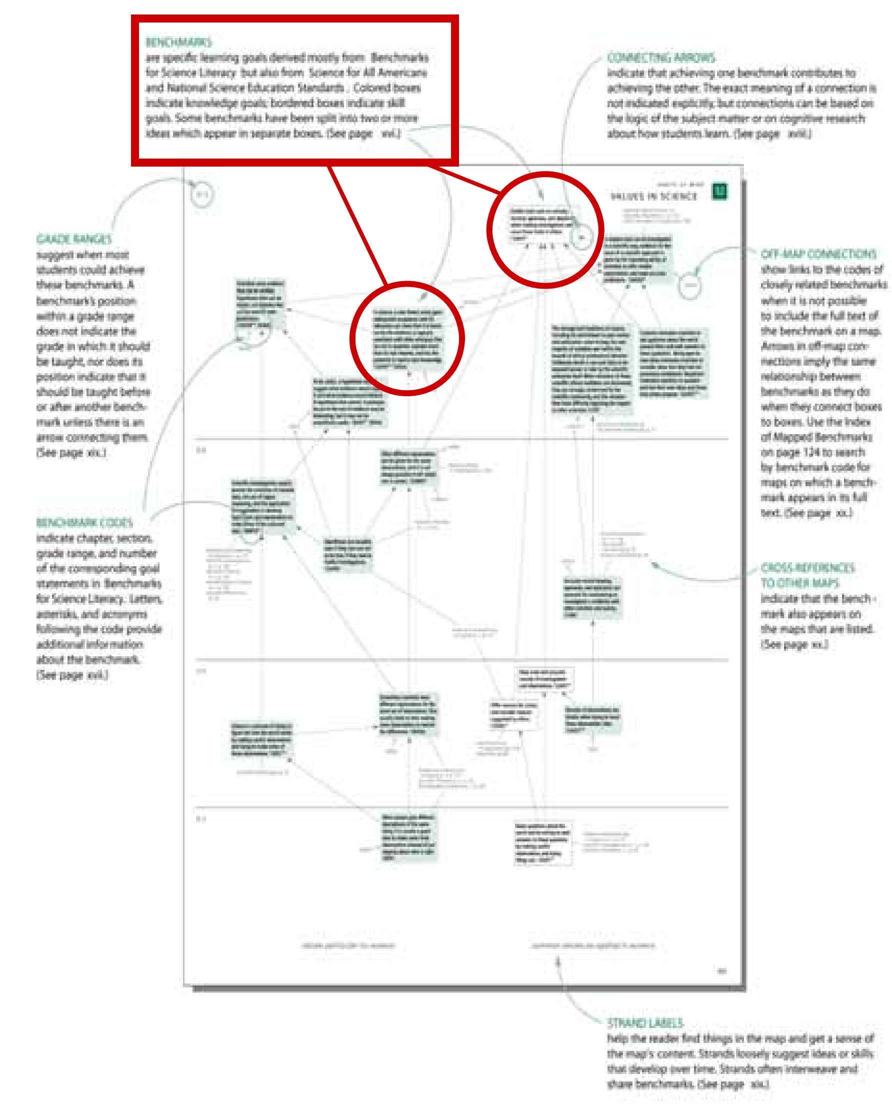


BENCHMARKS
are specific learning goals derived mostly from Benchmarks for Science Literacy but also from Science for All Americans and National Science Education Standards . Colored boxes indicate knowledge goals; bordered boxes indicate skill goals. Some benchmarks have been split into two or more ideas which appear in separate boxes. (See page xvi.)
CONNECTING ARROWS
indicate that achieving one benchmark contributes to achieving the other. The exact meaning of a connection is not indicated explicitly, but connections can be based on the logic of the subject matter or on cognitive research about how students learn. (See page xviii.)
VALUES IN SCIENCE
GRADE RANGES
suggest when most students could achieve these benchmarks. A benchmark's position within a grade range does not indicate the grade in which it should be taught, nor does its position indicate that it should be taught before or after another benchmark unless there is an arrow connecting them. (See page xix.)
OFF-MAP CONNECTIONS
show links to the codes of closely related benchmarks when it is not possible to include the full text of the benchmark on a map. Arrows in off-map connections imply the same relationship between benchmarks as they do when they connect boxes to boxes. Use the Index of Mapped Benchmarks on page 124 to search by benchmark code for maps on which a benchmark appears in its full text. (See page xx.)
BENCHMARK CODES
indicate chapter, section, grade range, and number of the corresponding goal statements in Benchmarks for Science Literacy. Letters, asterisks, and acronyms following the code provide additional information about the benchmark. (See page xvii.)
CROSS-REFERENCES TO OTHER MAPS
indicate that the benchmark also appears on the maps that are listed. (See page xx.)
STRAND LABELS
help the reader find things in the map and get a sense of the map's content. Strands loosely suggest ideas or skills that develop over time. Strands often interweave and share benchmarks. (See page xix.)

Map Key

BENCHMARKS

are specific learning goals derived mostly from *Benchmarks for Science Literacy* but also from *Science for All Americans* and *National Science Education Standards*. Colored boxes indicate knowledge goals; bordered boxes indicate skill goals. Some benchmarks have been split into two or more ideas which appear in separate boxes.



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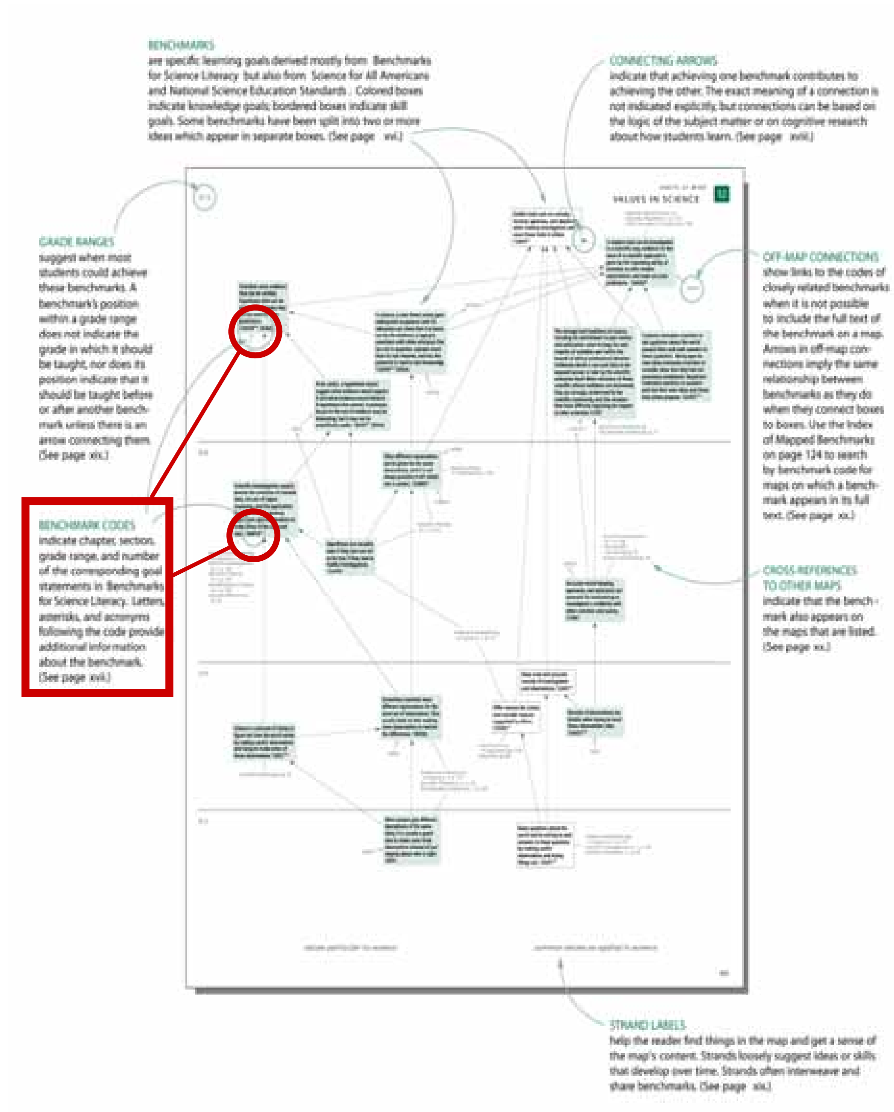
Map Key

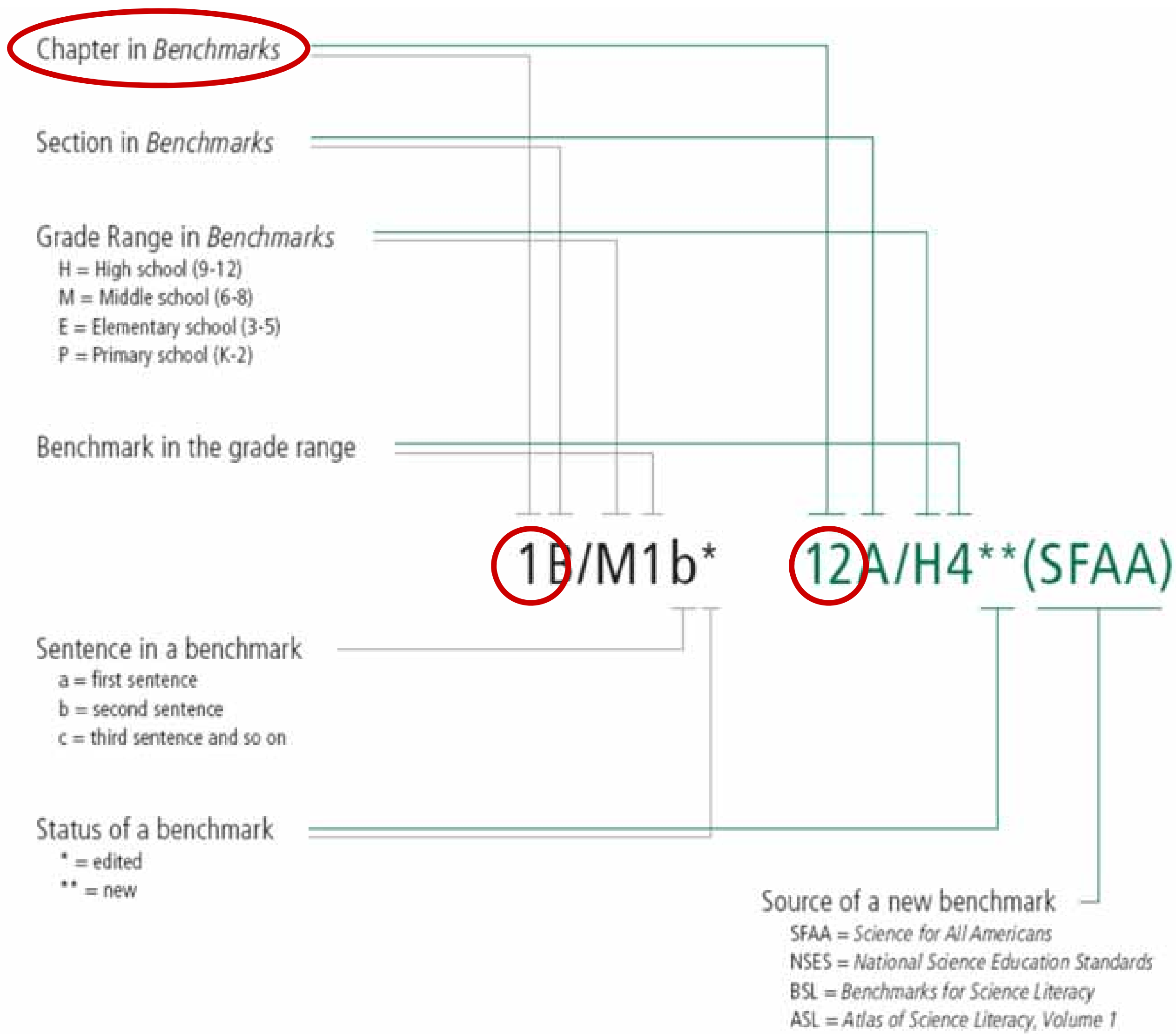
BENCHMARK CODES

indicate chapter, section, grade range, and number of the corresponding goal statements in *Benchmarks for Science Literacy.*

Letters, asterisks, and acronyms following the code provide additional information about the benchmark.



What’s in a Benchmark Code?



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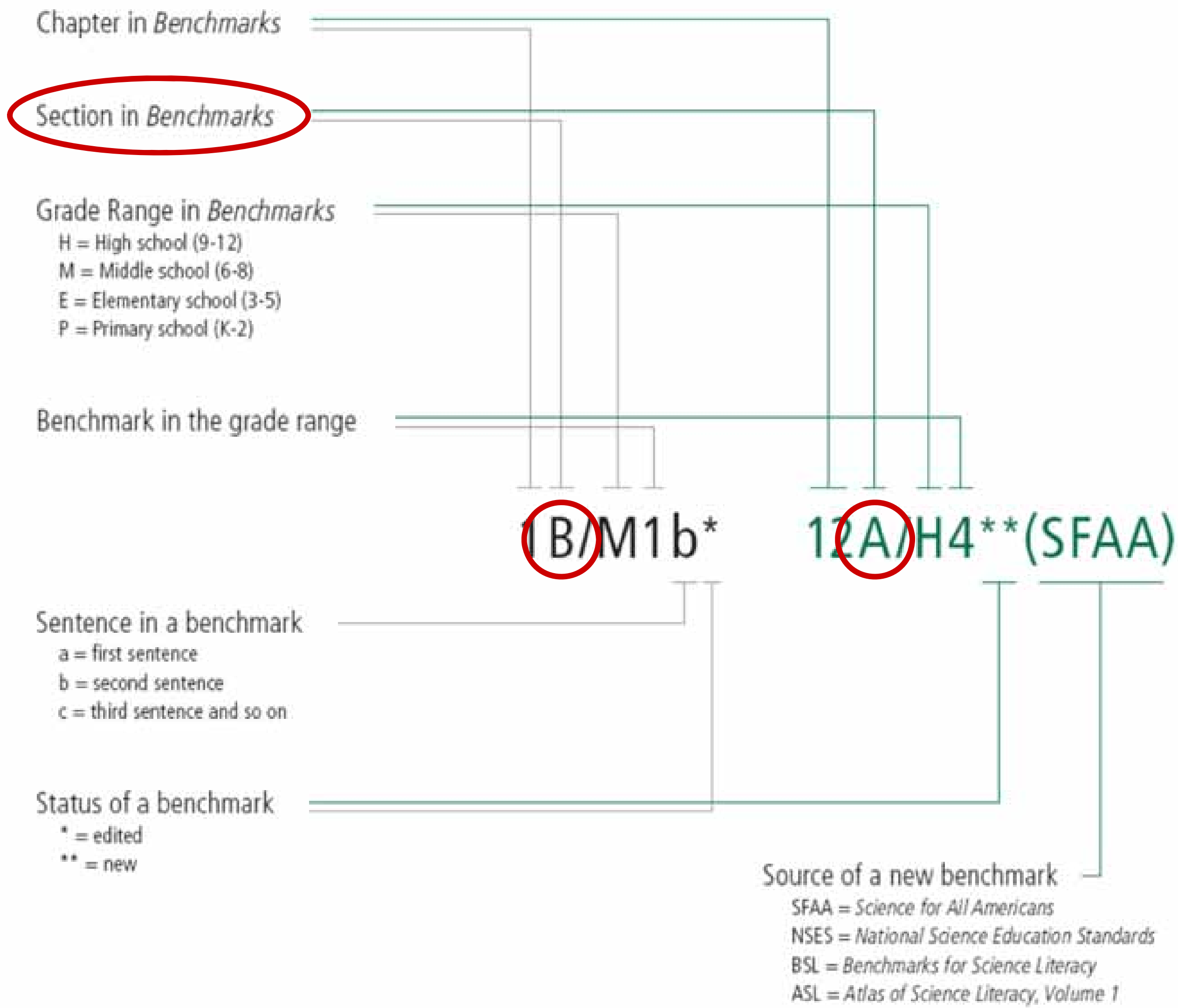

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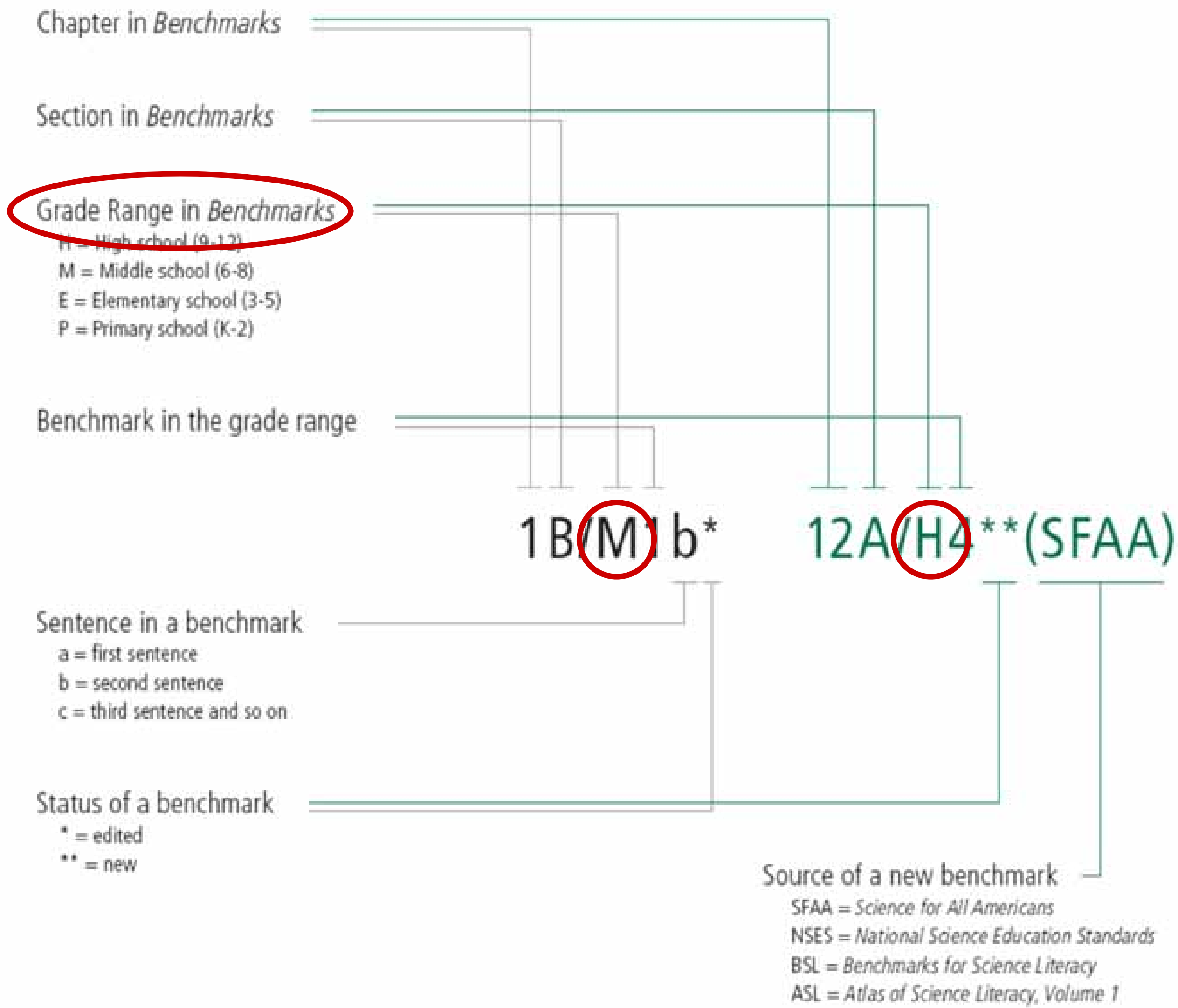

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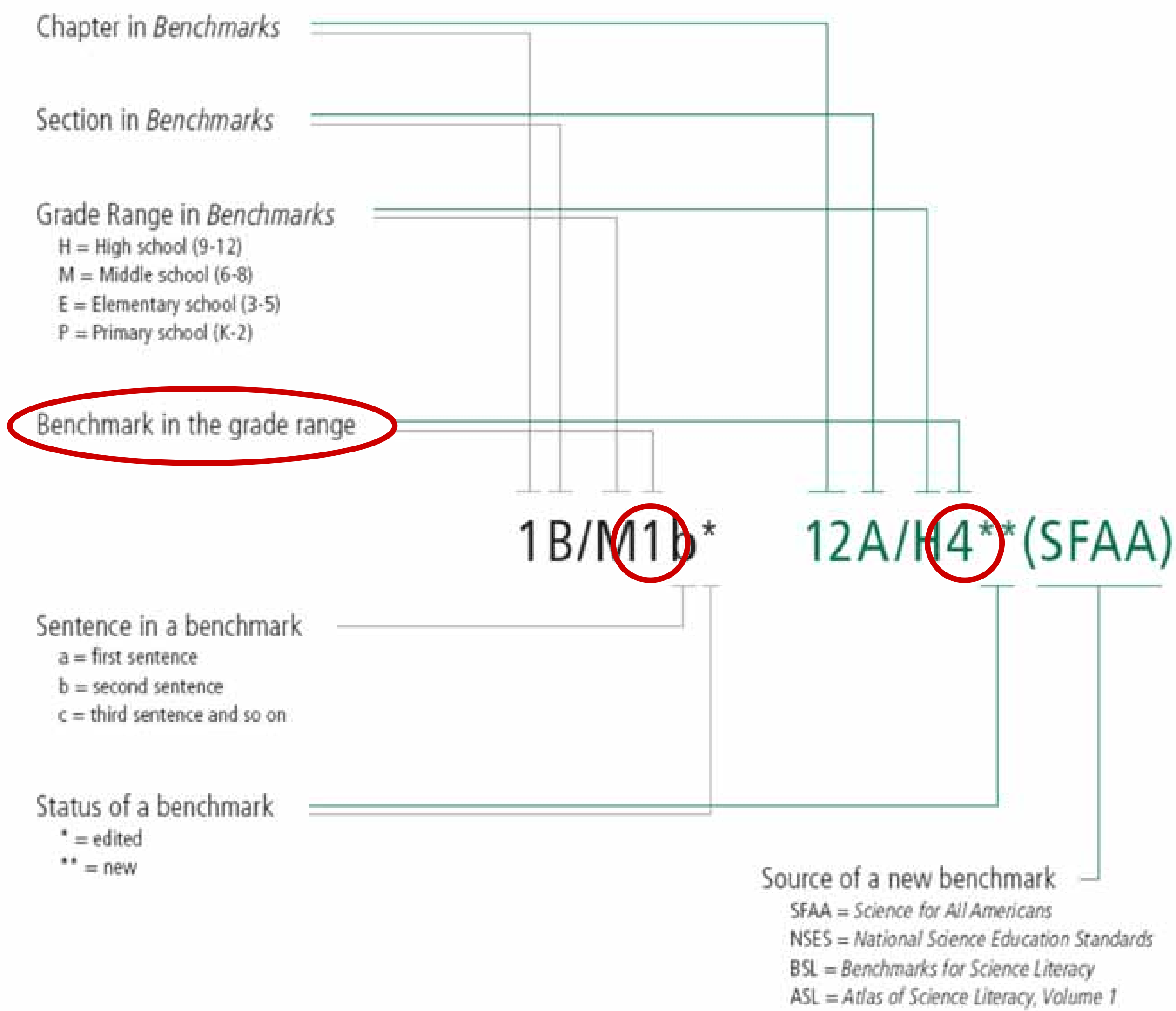

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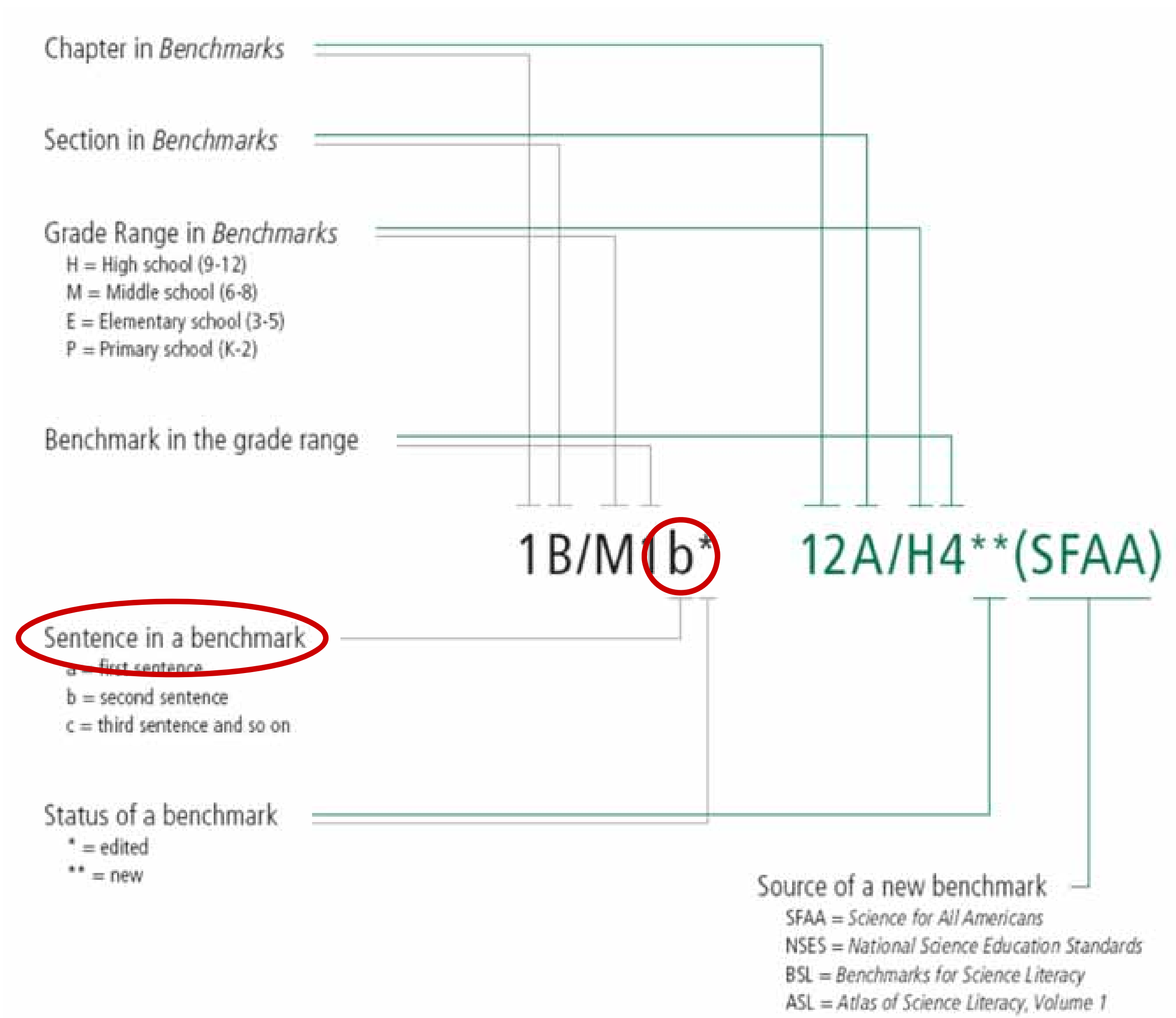
What's in a Benchmark Code?



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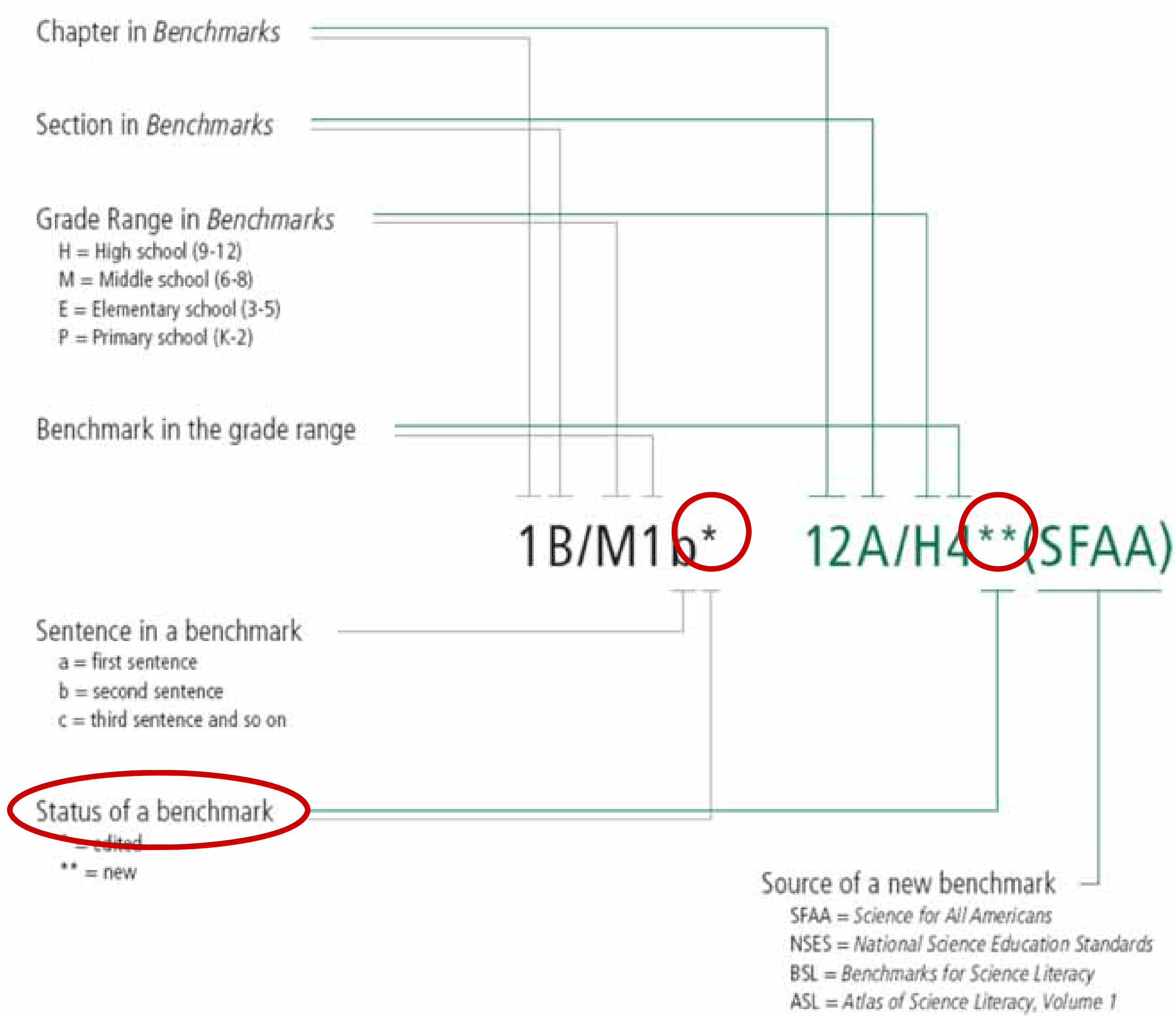
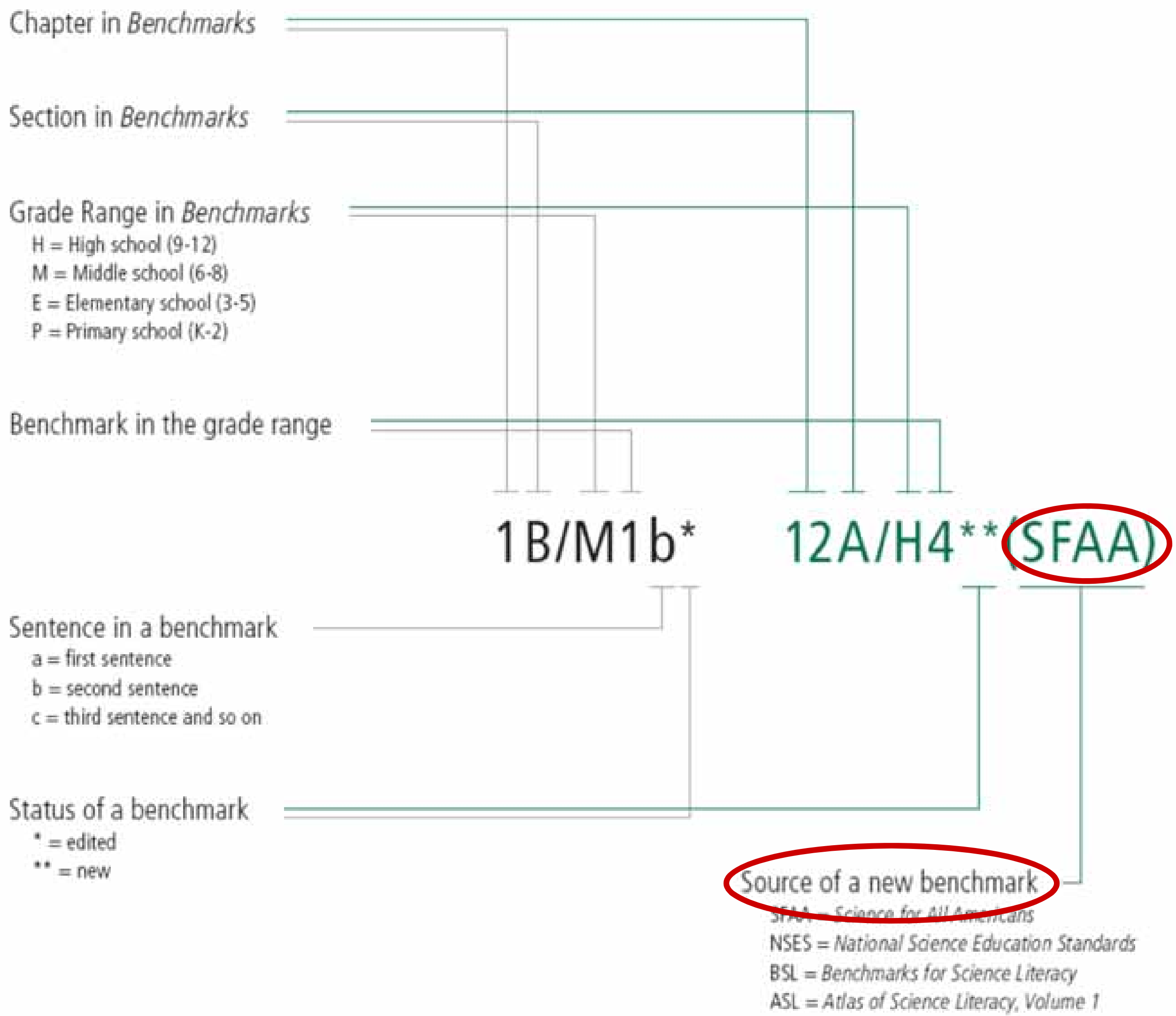
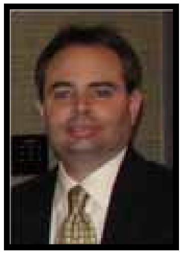


What's in a Benchmark Code?





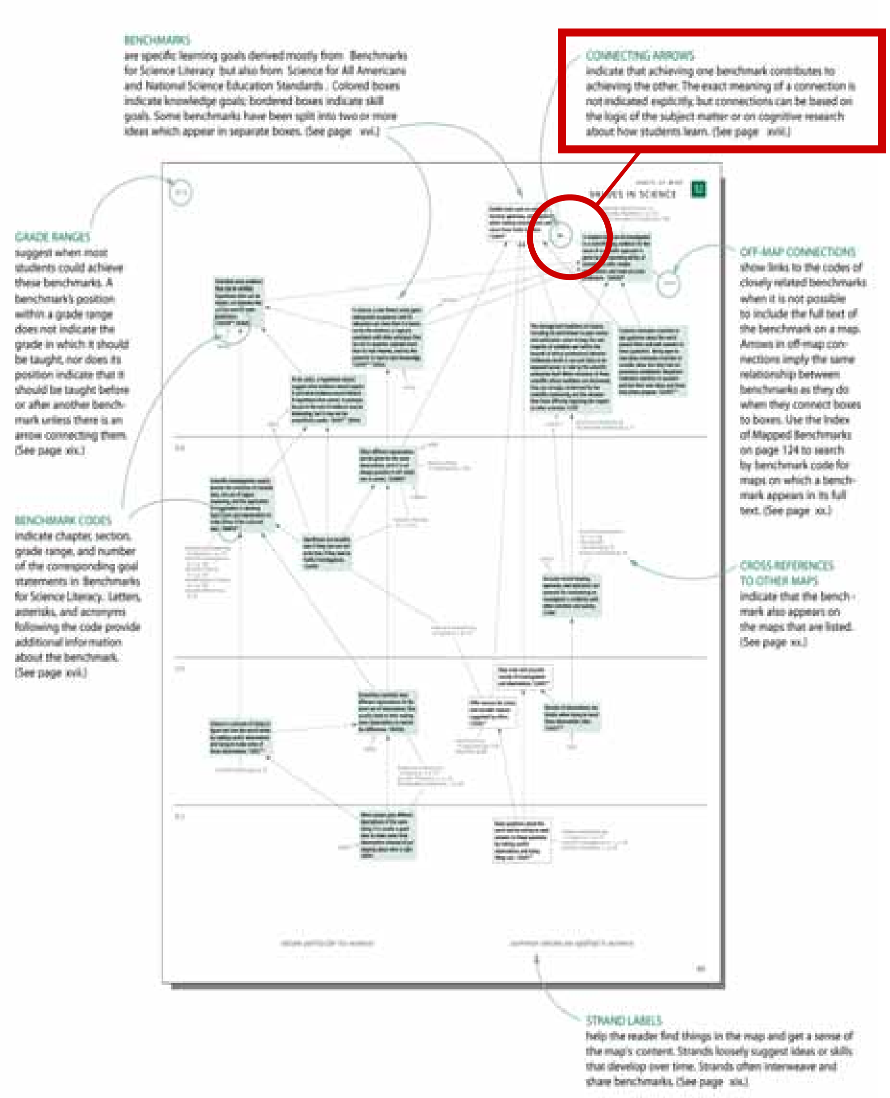
Let's Pause for Two Questions

Arrows on Maps

Map Key

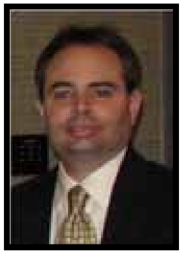
CONNECTING ARROWS

indicate that achieving one benchmark contributes to achieving the other. The exact meaning of a connection is not indicated explicitly, but connections can be based on the logic of the subject matter or on cognitive research about how students learn.



What does an Arrow mean?

- One idea “contributes to the understanding of the other”
- Knowing one idea can be “helpful in learning” the other idea.
- The idea may be an essential prerequisite, but does ***not*** have to be.



Is there a connection? If yes, which way does it run?

A

Air is a substance that surrounds us, takes up space, and whose movements we feel as wind.

No Arrow

When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets of water.

B

Air is a substance that surrounds us, takes up space, and whose movements we feel as wind.

↑

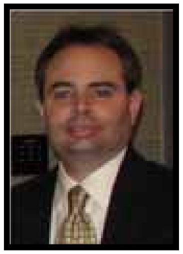
When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets of water.

C

When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets of water.

↑

Air is a substance that surrounds us, takes up space, and whose movements we feel as wind.



Is there a connection?
If yes, which way does it run?

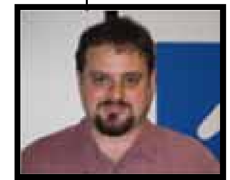
A Changes in speed or direction of motion are caused by forces. No Arrow An unbalanced force acting on an object changes its speed or direction of motion, or both.	**B** Changes in speed or direction of motion are caused by forces. ⟷ An unbalanced force acting on an object changes its speed or direction of motion, or both.
C An unbalanced force acting on an object changes its speed or direction of motion, or both. ↑ Changes in speed or direction of motion are caused by forces.	**D** Changes in speed or direction of motion are caused by forces. ↑ An unbalanced force acting on an object changes its speed or direction of motion, or both.

A warmer object can warm a cooler one by contact or at a distance. 4E/E2c

When warmer things are put with cooler ones, heat is transferred from the warmer ones to the cooler ones. 4E/E2b*

When liquid water disappears, it turns into a gas (vapor) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water. Clouds and fog are made of tiny droplets or frozen crystals of water. 4B/E3*

The weather is always changing and can be described by measurable quantities such as temperature, wind direction and speed, and precipitation. Large masses of air with certain properties move across the surface of the earth. The movement and interaction of these air masses is used to forecast the weather. 4B/E5** (NSES)



Air is a material that surrounds us and takes up space and whose movement we feel as wind. 4B/E4*

Water can be a liquid or a solid and can go back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing. 4B/P2

Water left in an open container disappears, but water in a closed container does not disappear. 4B/P3

The temperature and amount of rain (or snow) tend to be high, low, or medium in the same months every year. 4B/P1*

The sun warms the land, air, and water. 4E/P1

Draw arrows between benchmarks where it seems appropriate to do so.

Change is something that happens to many things. 4C/P2

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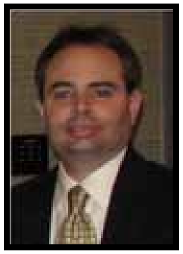
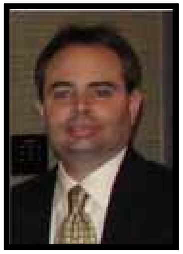


Let's Pause for Two Questions

Using Strand Maps



Uses of Strand Maps

How would you use a strand map?

1	
2	
3	

Uses of Strand Maps

- **Understanding Benchmarks**
- **Designing Curriculum**
- **Planning Instruction**
- **Developing and Evaluating Curriculum Materials**
- **Constructing and Analyzing Assessment**
- **Preparing Teachers**
- **Organizing Resources**

Uses of Strand Maps

- **Understanding Benchmarks** Maps help clarify the meaning of individual benchmarks and get a sense of what the benchmarks as a set are trying to achieve.

- **Designing Curriculum**
- **Planning Instruction**
- **Developing and Evaluating Curriculum Materials**
- **Constructing and Analyzing Assessment**
- **Preparing Teachers**
- **Organizing Resources**

Uses of Strand Maps

- **Understanding Benchmarks**

- **Designing Curriculum** Maps can help educators establish the responsibilities of different grades and subjects in growth toward literacy to ensure the cumulative effectiveness of instruction.

- **Planning Instruction**
- **Developing and Evaluating Curriculum Materials**
- **Constructing and Analyzing Assessment**
- **Preparing Teachers**
- **Organizing Resources**

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Uses of Strand Maps

- **Understanding Benchmarks**
- **Designing Curriculum**

- **Planning Instruction** Maps can help educators focus on what aspects of a particular benchmark are important for later learning. They also help identify what earlier conceptual understandings a struggling students might be missing.

- **Developing and Evaluating Curriculum Materials**
- **Constructing and Analyzing Assessment**
- **Preparing Teachers**
- **Organizing Resources**

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Uses of Strand Maps

- **Understanding Benchmarks**
- **Designing Curriculum**
- **Planning Instruction**

- **Developing and Evaluating Curriculum Materials** Maps offer materials developers a helpful perspective on what benchmarks to target when and can help them target the ideas in specific benchmark, rather than just in the general topic, at the appropriate level of sophistication.

- **Constructing and Analyzing Assessment**
- **Preparing Teachers**
- **Organizing Resources**

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Uses of Strand Maps

- **Understanding Benchmarks**
- **Designing Curriculum**
- **Planning Instruction**
- **Developing and Evaluating Curriculum Materials**

- **Constructing and Analyzing Assessment** Maps can help answer questions about when it is appropriate to assess particular ideas and skills, and why students might have trouble with a particular task.

- **Preparing Teachers**
- **Organizing Resources**

Uses of Strand Maps

- **Understanding Benchmarks**
- **Designing Curriculum**
- **Planning Instruction**
- **Developing and Evaluating Curriculum Materials**
- **Constructing and Analyzing Assessment**

- **Preparing Teachers** In both pre-service and in-service situations, teachers report that studying maps improves their own understanding of a topic, what their students are expected to learn in that topic, and how their students can attain that understanding.

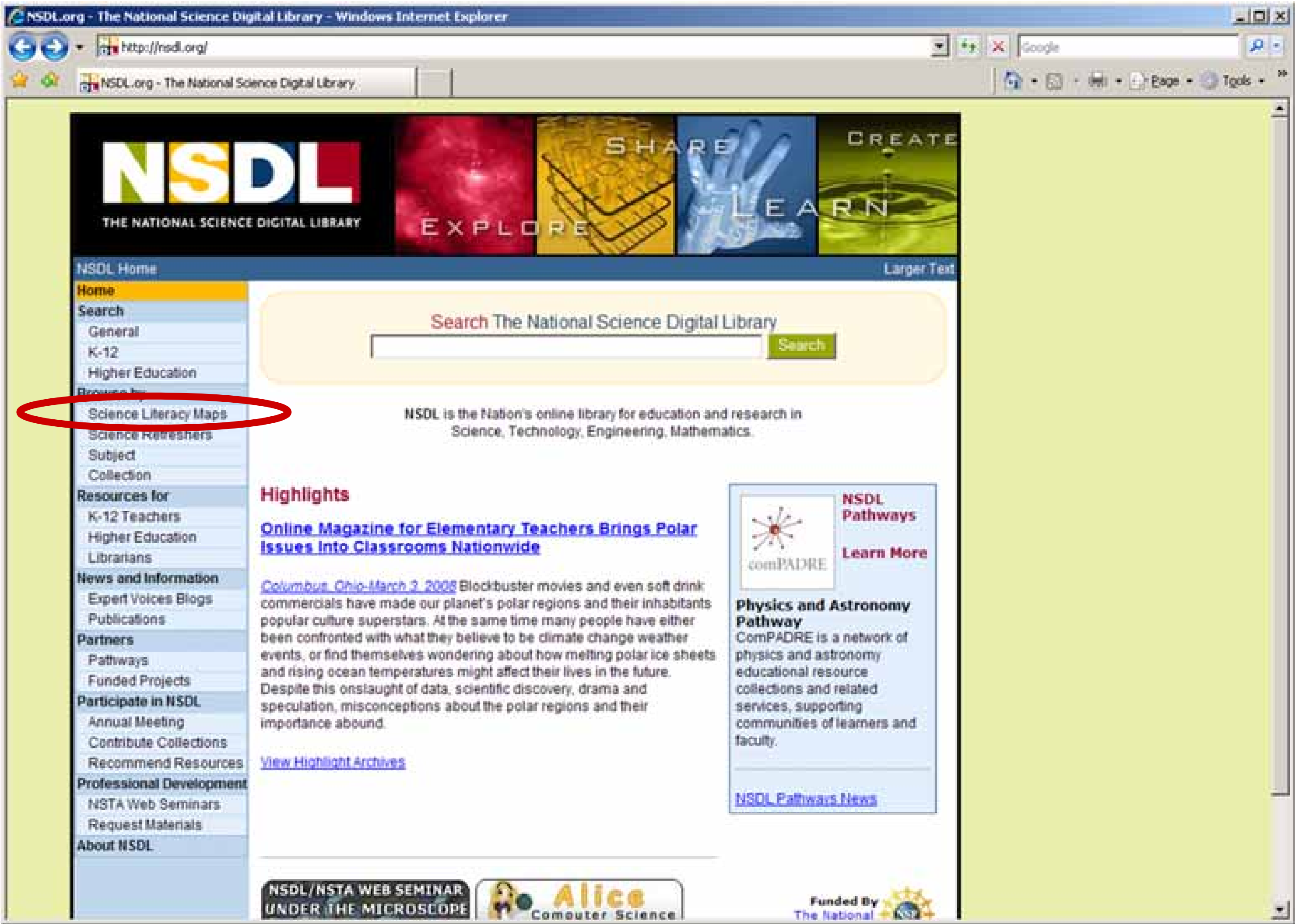
- **Organizing Resources**

Uses of Strand Maps

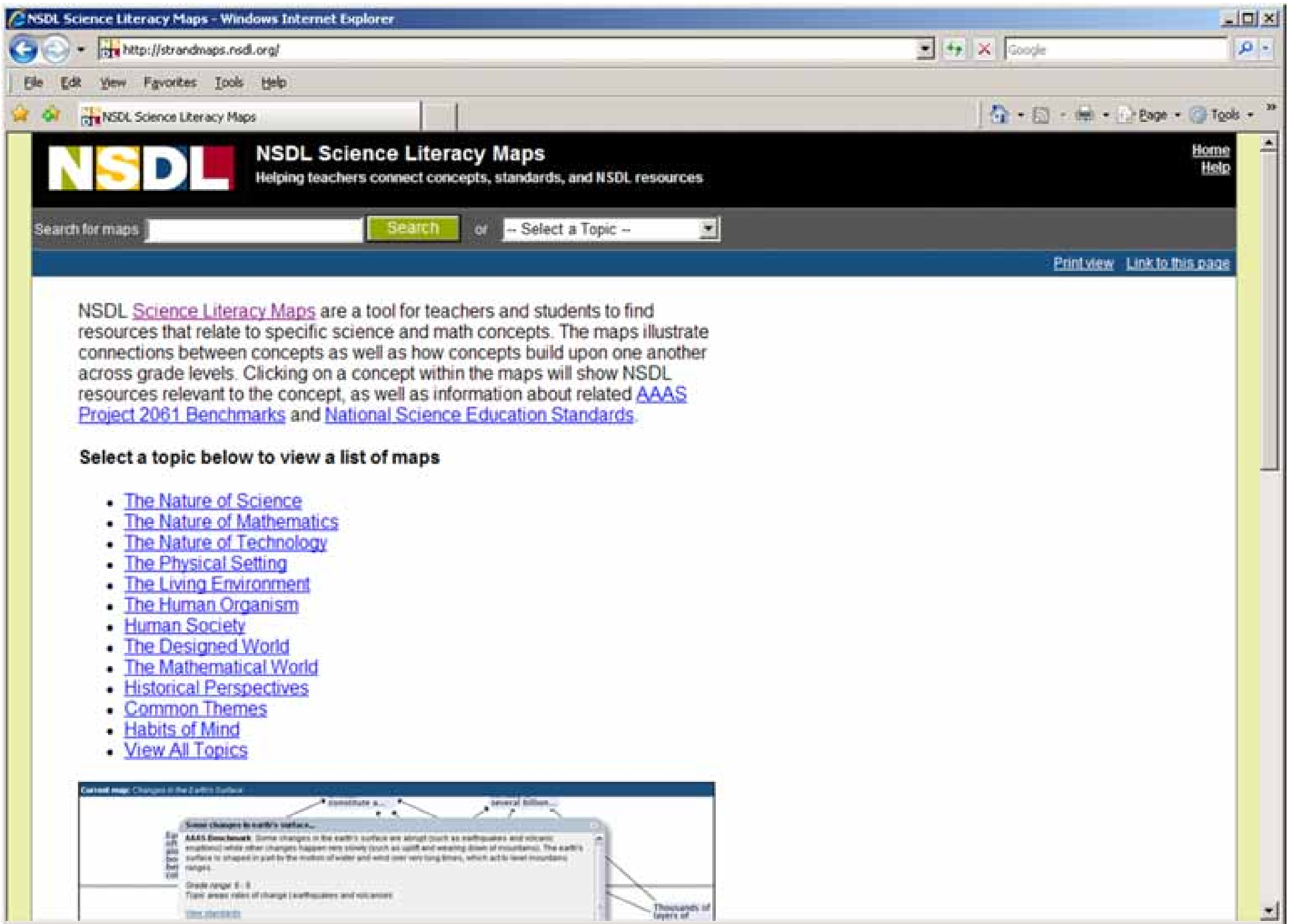
- **Understanding Benchmarks**
- **Designing Curriculum**
- **Planning Instruction**
- **Developing and Evaluating Curriculum Materials**
- **Constructing and Analyzing Assessment**
- **Preparing Teachers**

- **Organizing Resources** Maps have proved to be very useful as a tool for browsing resources in digital libraries.

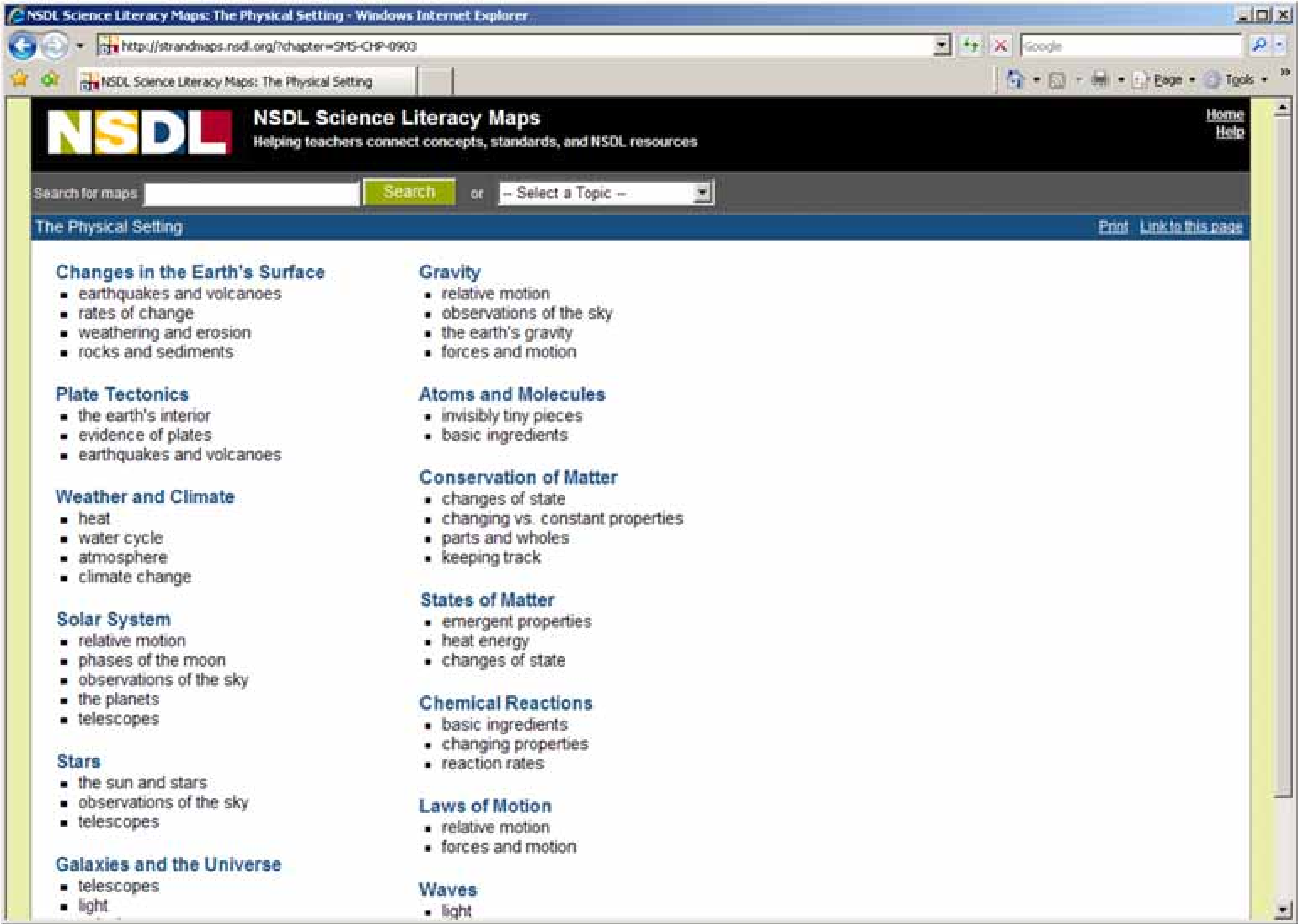
National Science Digital Library



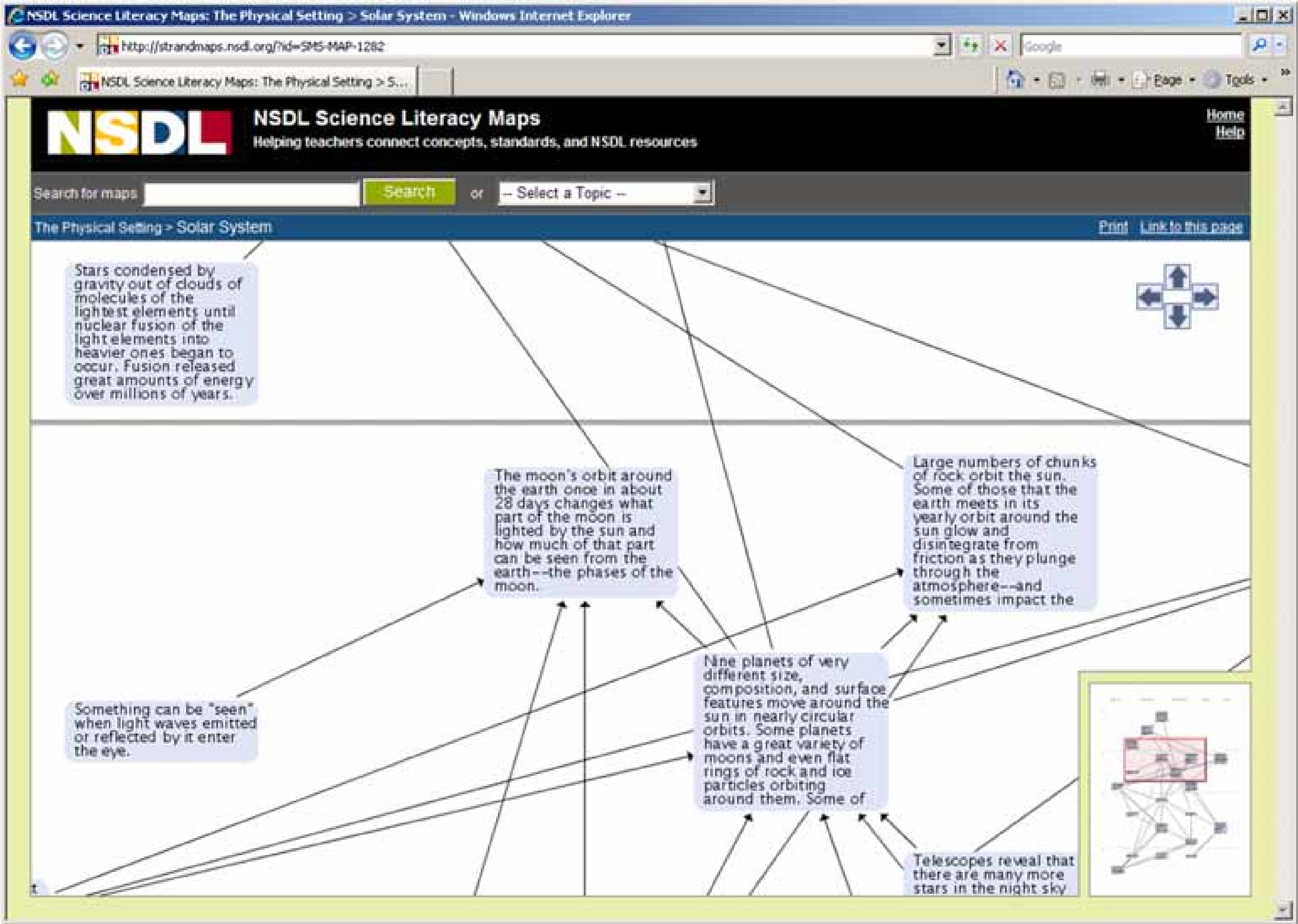
Users Select the Map They Want



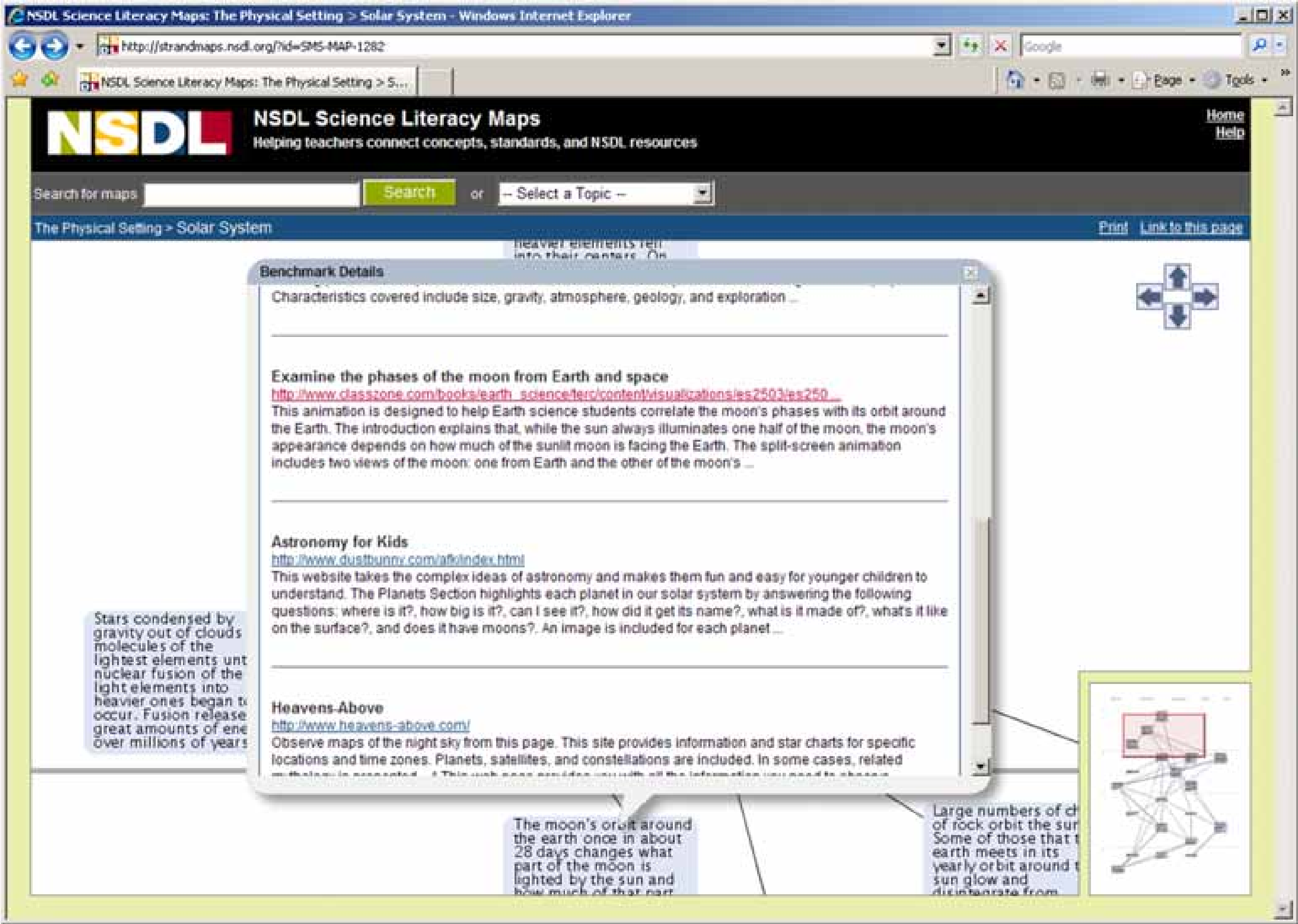
Users Select the Map They Want



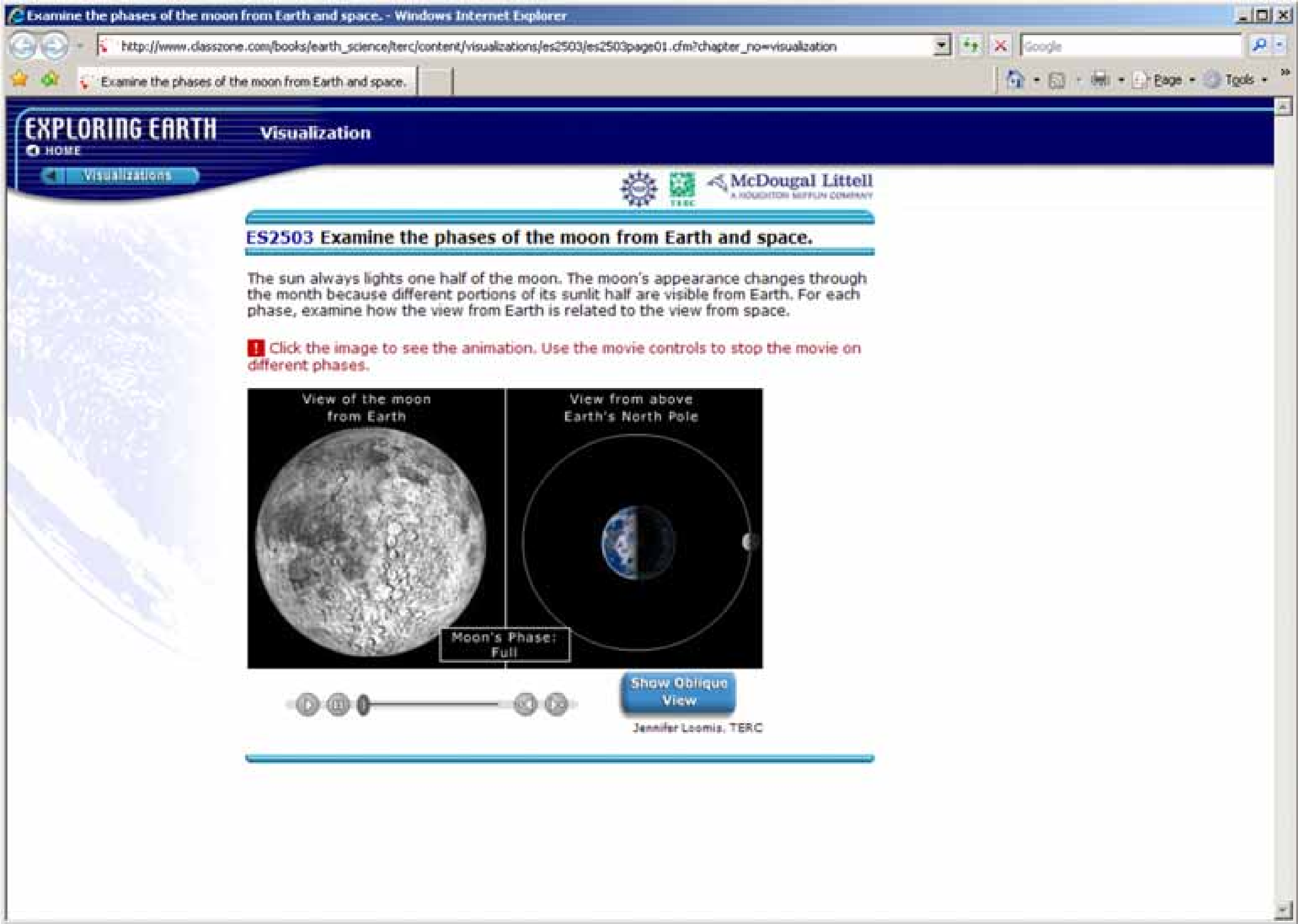
Click on a Benchmark



A list of Resources Will Pop Up



The Digital Libraries Pick the Resources



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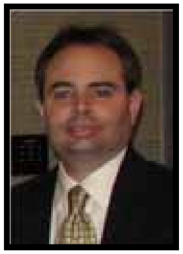
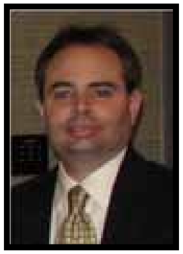


Let’s Pause for Two Questions

Thank You!



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