



Science Place: Air, Sun, and Water

Notes on Curriculum Analysis

The following preliminary analysis focuses on how well three lessons from *Science Place: Air, Sun, and Water* address two benchmarks: 4B *The Earth* (K-2)#3 and 4B *The Earth* (3-5)#3. The analysis of the lessons was guided by two sets of questions, one related to content and the other to pedagogy.

In analyzing curricula, reviewing the lessons in light of the content questions helps you to determine whether there is a content match to a particular benchmark. When there is a content match, the pedagogical questions are used to determine whether the instruction will contribute to students' learning the benchmark. The pedagogical questions reflect the principles of effective learning and teaching in *Science for All Americans*, Chapter 13.

In these three lessons, students have several experiences with water disappearing, but few experiences in which water in a closed container does not disappear (weather cup and towels in a plastic bag). The latter experiences are embedded in contexts that are more sophisticated than is appropriate for children of this age (see, for example, the weather cup activity). In any case, students are not encouraged to reflect on their experiences with open containers and closed containers as “a whole” so they can reach the generalization that “water in an open container disappears, but water in a closed container does not disappear.”

Even though *Science Place* is a grade one unit, the activities in lessons 10-12 seem to address the 4B(3-5)#3 benchmark rather than the 4B(K-2)#3 benchmark, although the pedagogical analysis indicates that neither benchmark is likely to be learned. The analysis results for each benchmark are presented in two parts, Content Match and Pedagogical Match.

Benchmark 4B *The Earth* (K-2)#3

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

Lesson	Pages	Content Match - Evidence
10	44-47	Students observe that watered soil in a cup dries up when it is left open. They discuss where the water went (p. 47, Extend Learning). Students talk about where the water in fish tanks goes (p. 47, Option 1).

Lesson	Pages	Content Match - Evidence (continued)
11	48-51	Students talk about their experience with things (such as their hair or puddles on the sidewalk) drying out (p. 50, Activate). They make water paintings and talk about what happens to the water as the paintings dry (p. 51, Explore). Students are asked whether water in water cups disappears and how they could keep the water they painted with from disappearing (p. 51, Apply). Students observe that water from open dishes disappears over time (p. 51, Option 1).
12	52-55	Students predict, and then observe, what happens to wet towels hung in the sun and in the shade and discuss where the water in the towels goes (pp. 54, 55). Students discuss what will happen if a wet towel is put in a plastic bag (p. 55, Explore).
Lesson	Pages	Pedagogical Match - Evidence
10	44-47	<p>Students observe that watered soil in a cup dries up if the cup is left open. They <i>discuss</i> where the water went (p. 47, Extend Learning). Teacher asks where the water in fish tanks goes (p. 47, Options).</p> <p>Research indicates young children believe that when water evaporates it ceases to exist, or that it changes location but remains a liquid (see <i>Benchmarks</i>, Chapter 15: The Research Base). Teachers are not alerted to students' ideas nor provided with suggestions on how to help them develop these ideas.</p> <p>Discussions on open cups and open fish tanks follow activity with weather cup (pp. 46, 47). These discussions are too difficult for first grade children to understand.</p>
11	48-51	The Content Background (p. 49) presents ideas at a much higher level of sophistication than is appropriate for most elementary school students. Although the notes presented may be helpful to teachers in reviewing the content background of the explorations, there is a danger that they will present the content to students at the same level of sophistication. This danger is larger because no information is provided to teachers about the developmental level of the

Lesson	Pages	Pedagogical Match - Evidence (continued)
11	48-51	<p>students or what progress students can reasonably be expected to make toward understanding the concepts of evaporation and condensation at this age.</p> <p>Teacher and students talk about several experiences of things drying out, such as their hair, water puddles on sidewalks, water painting, and “puddles” of water in dishes, and may discuss where water goes (pp. 50, 51).</p> <p>On p. 51 (Apply), students are asked how they could find out what happens to the water on their water paintings. However, the time suggested for this activity (5-10 minutes) is too short, and there are no explicit suggestions to the teacher for appropriate investigations.</p> <p>The term evaporation is introduced before the concept (which is too sophisticated for first-grade children).</p> <p>The Assessing Performance notes (p. 51) suggest expectations that are developmentally inappropriate for first-grade children: “(. . .) their discussions should indicate an awareness that water was absorbed into the air.”</p>
12	52-55	<p>Students discuss and reflect on investigation with towels (p. 55). Questions on placing the towel in a plastic bag could be helpful in developing students’ thinking.</p>

Summary:

The lessons cited provide evidence for a content match for *Science Place* and the benchmark 4B *The Earth* (K-2)#3:

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

4B The Earth (3-5)#3

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 down below the freezing point of water. Clouds and fog are made of tiny droplets of water.

Lesson	Pages	Content Match - Evidence
10	44-47	Weather cup activity deals with appearance of moisture on the sides of a cup (p. 46). Students are asked where the water comes from (p. 47, Apply). Extend Learning and Option 1 (p. 47) deal with the disappearance of liquid water. Students are asked where the water goes (p. 47).
11	48-51	Notes to teachers (p. 50, Explore) suggest students discuss where the water goes as their water paintings dry out. Process Assessment (p. 51) suggests that discussions related to activities in this lesson should indicate an awareness that water was absorbed into the air. Option 1 (p. 51) alludes to increased rate of evaporation with heat.
12	52-55	Placemat (p. 52) notes that water, for example, water from paintings, can move into the air. Questions 1, 2, 3 in Activate (p. 54) suggests that heat and air influence the rate of evaporation. Questions “what happened to the water in the towels? where did it go?” (p. 55, Apply) may suggest evaporation of water into the air.

Lesson	Pages	Pedagogical Match - Evidence
10	44-47	Students are provided with opportunities to express their ideas about where the water in an open cup or a fish tank goes when it disappears (p. 47, Extend Learning/Option 1), and where water that appears on the sides of the water cup comes from (p. 47, Apply).

Lesson	Pages	Pedagogical Match - Evidence (continued)
10	44-47	<p data-bbox="618 451 1393 909">The activity with the weather cups (p. 46, 47) is likely to be confusing for first graders. First, it is not clear from the description of the activity which elements of the weather cup model students are expected to map onto the water cycle or weather on earth. Secondly, students are not provided with help to map between the model and the weather (for example, they are not asked to observe that the soil has dried or to link the disappearance of water from the soil with the appearance of water on the sides of the cup; and they are not encouraged explicitly to make a connection between these phenomena and the appearance of moisture in the atmosphere and rain).</p> <p data-bbox="618 951 1393 1249">Thirdly, teachers are not alerted to difficulties students may have in interpreting the model in the intended way. Given the limited help provided to students and teachers, and the complexity of the activity, it is unlikely that, based on this activity, students will see that “condensation on the inside of the cups is related to rain outside because both are part of the water cycle” (p. 47). It is not clear, in fact, what the authors mean by this statement.</p> <p data-bbox="618 1291 1393 1365">Students are not given opportunities to express their ideas about where rain comes from.</p> <p data-bbox="618 1407 1393 1591">No experiences or discussion are provided to help students understand that, when the water disappears, it moves into the air. We know, however, from research that this concept is not easy for lower elementary school students to understand.</p> <p data-bbox="618 1633 1393 1785">The term “evaporate” is introduced without any explanation about what it means. Students do not have sufficient experience with the idea that when water disappears, it becomes vapor in the air before the term is introduced.</p>

Lesson	Pages	Evidence for Pedagogical Match
12	51-55	<p>Opportunities are provided for students to make explicit their ideas about the factors that influence the rate of evaporation. Students are engaged in activities (such as observing towels drying in the sun, in the shade, or in front of a blowing fan [pgs.52 and 53]) and are provided with opportunities to reflect on the activities.</p> <p>Lower elementary school students are unlikely to make sense of questions about why a towel will not dry if it is in a plastic bag or another closed container. No suggestions are provided to the teacher about the level of explanation expected here.</p>

Summary:

The lessons cited provided evidence for a content match for *Science Place* and the part of the benchmark 4B *The Earth (3-5)#3* shown in bold:

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.

Students are not likely to learn the highlighted part of the benchmark in these three lessons. The water cup activity in Lesson 10 is unclear in its direction and discussion with students about where the water goes and how it condenses on the side of the cup. Technical terms like “condensation” and “evaporation” are used before the students have had sufficient experiences or examples that would contribute to understanding. Also, teachers are not alerted to misconceptions or difficulties that students may be experiencing.