

1st Grade Weather Unit

Student Misconceptions

Misconceptions about the Water Cycle

Students' ideas about conservation of matter, phase changes, clouds, and rain are interrelated and contribute to understanding the water cycle. Students seem to transit a series of stages to understand evaporation. Before they 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). With special instruction, some students in 5th grade can 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). This appears to be a challenging concept for upper elementary students (Sere, 1985). Students can understand rainfall in terms of gravity in middle school but not the mechanism of condensation, which is not understood until early high school (Bar, 1989). (AAAS, 1993, p. 336)

Four stages in children's progression of understanding of evaporation and condensation:

1. Water disappears, prevalent with younger students;
2. Water is absorbed into surfaces, a view that appears at about age 7. This represents a move from a descriptive to a reasoning view in which children reconcile their adoption of a conservation view with the contradictory fact of water no longer being perceptible;
3. Water is transferred ('evaporates') to another (upward) location such as the sky, clouds, ceiling or 'air'. The transition to this view occurs at about age 9, with children's developing views about air, but appears earlier with the boiling phenomenon because of the readily apparent agency of heat providing the upward move; and
4. Water disperses into air, associated with a phase change. This view becomes predominant by age 13. (Tyler, 2000, p. 450)

Misconceptions about Rain

Rain occurs when water drops in the cloud are too heavy to remain airborne. Many students think:

1. rain occurs because we need it;
2. rain falls out of the sky when the clouds evaporate;
3. rain comes from holes in clouds (like salt from a salt shaker);
4. rain comes from clouds sweating;
5. rain occurs when clouds are shaken (by the wind);
6. rain occurs when clouds collide;
7. rain occurs when clouds become too heavy;
8. rain comes from clouds melting; and/or
9. rain falls from funnels in the clouds. (Henriques, 2000, p. 6)

Misconceptions about Clouds

Clouds are created when water vapor condenses onto dust or other particles in the air. The water vapor is in the atmosphere as a result of evaporation of water from the surface of the earth, and from respiration of plants and animals. A visible cloud is primarily tiny water droplets and/or tiny ice crystals; it is not water vapor. (Henriques, 2000, p. 6)

Some students believe clouds go to the sea and get filled with water. Students with this idea view the water cycle only in terms of liquid water – there is no phase change required for this model. The next stage is for students to view the water cycle in terms of water boiling – for students in this state the only way water becomes a gas is through boiling (i.e., no evaporation). (Henriques, 2000, p. 6)

Many students also think clouds:

1. come from somewhere above the sky;
2. are formed by boiling – vapors from kettles or the sun boiling the sea;
3. are made of cold, heat, fog, snow or nighttime;
4. are mostly smoke, made of cotton or wool, or they are bags of water;
5. are sponges that hold water;
6. are water vapor; and/or
7. are dust particles. (Henriques, 2000, pp. 6-7)

Possible source of misconception: cloud formation is often demonstrated with a tea kettle; evaporation is a liquid turning into a gas—just like boiling; when clouds and water vapor demonstrations are done in school students see the condensed water as a cloud but think they are seeing water vapor (which is actually invisible); clouds of cotton or other substances might result from our descriptions of clouds or art projects. (Henriques, 2000, p. 7)

Sources

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Tyler, R. (2000). A comparison of year 1 and year 6 students' conceptions of evaporation and condensation: Dimensions of conceptual progression. *International Journal of Science Education*, 22(5), 447-467.