2nd Grade Matter Unit
Student Misconceptions

Misconception about the Nature of Science and Scientific Inquiry (AAAS, 1993, p. 33)

Some students of all ages believe science mainly invents things or solves practical problems rather than exploring and understanding the world.

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 (Russel & 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)

<u>Misconceptions about Constancy and Change</u> (AAAS, 1993, p. 357)

Lower elementary-school students fail to conserve weight and volume of objects that change shape. When an object's appearance changes in several dimensions, they focus on only one. They cannot imagine a reversed or restored condition and focus mostly on the object's present appearance (Gega, 1986). The ability to conserve develops gradually. Students typically understand conservation of number between the ages of 6 and 7, of length and amount (solid and liquid) between 7 and 8, of area between 8 and 10, of weight between 9 and 11, and of displaced volume between 13 and 14. These ages will vary when different children are tested or the same children are tested in different contexts (Donaldson, 1978).

Primary Sources:

American Association for the Advancement of Science (1993). *Benchmarks for science literacy*. New York: Oxford University Press.

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.

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