

## The Physical Setting > States of Matter

### Research on Student Learning

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.).<sup>[1]</sup> With special instruction, some students in 5th grade can identify the air as the final location of evaporating water.<sup>[2]</sup> Students in 5th grade must accept air as a permanent substance before they can identify the air as the final location of evaporating water.<sup>[3]</sup> The idea that air is a permanent substance appears to be a challenging concept for upper elementary students.<sup>[4]</sup> Students of all ages show a wide range of beliefs about the nature and behavior of particles. They lack an appreciation of the very small size of particles; believe there must be something in the space between particles; have difficulty in appreciating the intrinsic motion of particles in solids, liquids and gases; and have problems in conceptualizing forces between particles.<sup>[5]</sup> Despite these difficulties, there is some evidence that carefully designed instruction carried out over a long period of time may help middle-school students develop correct ideas about particles.<sup>[6]</sup>

### References

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[4] Sere, M. (1985). The gaseous state. In Driver, R. (Ed.), *Children's ideas in science* (pp. 105-123).

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