Research on Student Learning

The Science Curriculum Improvement Society (SCIS) curriculum led children to approach observation and analysis of natural phenomena by thinking of them as systems of interacting objects. [1] Research done in connection with SCIS indicates elementary students may believe that a system of objects must be doing something (interacting) in order to be a system or that a system that loses a part of itself is still the same system. [2] Studies of student thinking show that, at all ages, they tend to interpret phenomena by noting the qualities of separate objects rather than by seeing the interactions between the parts of a system. [3] Force, for instance, is considered as a property of bodies (forcefulness) rather than as an interaction between bodies. Similarly, students tend to think that whether a substance burns or not is being solely decided by the substance itself, whereas from a scientist's perspective, the process of burning involves the interaction of the burning substance and oxygen. [4]

When students explain changes, they tend to postulate a cause that produces a chain of effects one after another. [5] In considering a container being heated, students think of the process in directional terms with a source applying heat to the receptor. From a scientific point of view, of course, the situation is symmetrical, with two systems interacting, one gaining energy and the other losing it. [6]

Concentrating on the inputs and outputs of a system often requires a different, time-independent view, which students may not take to be an explanation. Students often do not seem to appreciate that the idea of energy conservation may help explain phenomena. Studies reporting students' difficulties with energy conservation suggest students should have opportunities to describe systems both as sequences of changes over time and as energy inputs and outputs (a systems approach). [7]

Student explanations of material change seldom include certain kinds of causes that are central to a scientific understanding of the world. [8] Student explanations of material change seldom include the notion that parts interact to produce wholes that have properties the parts do not. For children, wholes are like their parts. [9]

References

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