CONCEPTS, METAPHORS AND CONCEPTUAL CHANGE IN SCIENCE LEARNING: A CONCEPTUAL METAPHOR PERSPECTIVE

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One of the main goals of the field of cognitive linguistics is to identify the many subtle conceptual construals implicit in linguistic choices. This has included identifying vast patterns of metaphorical construals in everyday language use not usually recognized as metaphorical. For example, time is conceptualized in terms of movement in space (as in *winter is coming; I can't wait until we get to summer*) and sometimes as a resource (as in *don't waste more time*; *time is running out*). Other examples (among many identified in the literature) are emotional states construed as containers (as in *I'm in a bad mood*; *he's in love*); goals are construed as destinations (as in *I'm moving in the right direction in my career*); and causes are construed as forces (as in *the performance lifted the crowd to their feet*). The theory of conceptual metaphor, developed based on these analyses, makes two central claims: that metaphorical expressions reflect underlying systematic mappings between conceptual domains; and that abstract conceptual domains are understood metaphorically in terms of more concrete, experiential knowledge. This more concrete knowledge is in the form of image schemas – that is, abstractions from repeated sensorimotor experiences - such as containment, moving objects, path, and forced movement. These claims offer those of us interested in science learning a way of thinking about how an understanding of abstract scientific concepts might be acquired. We have shown that even scientific concepts as abstract as the concept of energy are construed metaphorically in terms of image schemas: energy exchange can be construed as movement of a substance (as in *put energy into the gas*); forms of energy can be construed as containers (as in *the energy was stored in potential chemical energy*); and energy conservation book-keeping can be done construing energy in terms of a part-whole schema (as in *part of the system's energy was in the kinetic energy of the particles*). A lot of research on science learning and instruction over the last decade or so has used ideas from the theory of conceptual metaphor. This work has shown the relevance of a conceptual metaphor perspective to characterizing expert scientific understanding and reasoning, assessing and characterizing learner conceptions, describing the process of conceptual change, selecting and designing instructional representations and analogies and designing science curricula. In this talk, I will review this research, highlighting in particular how a conceptual metaphor perspective contributes to understanding conceptual change in science learning and what new questions it suggests. But I will argue that for substantial progress to be made in using a conceptual metaphor perspective to understand conceptual change, we need a clearer account of where conceptual metaphors fit in a theory of concepts. Specifically, I will argue that it is useful to integrate the perspective of conceptual metaphor with a view of concepts that emphasizes both how a concept refer to things in the world and participates in an inferential network.

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