Crosscutting Concepts

Cross-Cutting Concepts: Crossing Over into Another Dimension

The third dimension is equally as important as the first two. Content (Disciplinary Core Ideas) consists of *what* is being studied. Practices guide *how* the content is being explored. Cross-cutting concepts provide the *focus* and sharpen the content and practice by looking at them through specific lenses.

In this Prezi below, your trainer will discuss two methods of implementing Cross-Cutting Concepts (CCC's), the unit method and the phenomena method. Throughout this dimension of the Toolkit, the phenomena method will be used as a guiding example in how to implement each CCC. The Toolkit is not meant to serve as a blanket recipe box for classroom implementation. Your experience with your trainer in this dimension of the Toolkit will provide you with the tools to implement the third dimension to suit your content, style, and classroom needs; it will prepare you ultimately for unit implementation of CCC's.

> *Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at an ancient civilization, the human body, or a comet. They are ideas that transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design.*
> *–American Association for the Advancement of Science [1].*

In the Words of the Framework…

Although crosscutting concepts are fundamental to an understanding of science and engineering, students have often been expected to build such knowledge without any explicit instructional support. Hence the purpose of highlighting them as Dimension 2 of the framework is to elevate their role in the development of standards, curricula, instruction, and assessments. These concepts should become common and familiar touchstones across the disciplines and grade levels. Explicit reference to the concepts, as well as their emergence in multiple disciplinary contexts, can help students develop a cumulative, coherent, and usable understanding of science and engineering.

Although the framework does not specify grade band endpoints for the crosscutting concepts, it does lay out a hypothetical progression for each. Like all learning in science, students' facility with addressing these concepts and related topics at any particular grade level depends on their prior experience and instruction. The research base on learning and teaching the crosscutting concepts is limited. For this reason, the progressions we describe should be treated as hypotheses that require further empirical investigation.

Crosscutting Concepts Summarized

1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
2. Cause and effects: Mechanism and explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by

which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.

3. *Scale, proportion, and quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.*
4. *Systems and system models. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.*
5. *Energy and matter: Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.*
6. *Structure and function. The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.*
7. *Stability and change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.*

Students' understanding of these crosscutting concepts should be reinforced by repeated use of them in the context of instruction in the disciplinary core ideas of Dimension 3. In turn, the crosscutting concepts can provide a connective structure that supports students' understanding of sciences as disciplines and that facilitates students' comprehension of the phenomena under study in particular disciplines.

Thus these crosscutting concepts should not be taught in isolation from examples provided in the disciplinary context. Moreover, use of a common language for these *concepts across disciplines will help students to recognize that the same concept is relevant across different contexts.*

Text from A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas p. 85
