

Rocks and Landforms Facets



Overview of Facets and Facet Clusters

Background

Beginning with the research on misconceptions and conceptual change, the term “**facets of students’ thinking**” was coined by Jim Minstrell and his colleagues to acknowledge that not all of students’ thinking can be considered a “misconception” or error. Learners faced with a new task are making the best sense they can based on their ideas and past experiences. The facets perspective assumes that all students possess some strengths to build on, possibly in addition to problematic thinking that can be revised through learning opportunities.

Definitions and Uses

A **facet** is an idea or piece of knowledge that a learner uses to solve a problem or explain an event. A facet may be an idea that represents a learning goal (**goal facet**) or an idea that represents problematic thinking (**problematic facet**).

Goal facets and problematic facets related to a similar concept or event can be organized into a **facet cluster**. Facet clusters serve to represent the multitude of common ways that students think and reason in a domain. They also serve as a framework for analyzing student responses to questions and for identifying students’ learning needs.

Organization of Facet Clusters

Facet clusters are arranged with the goal facets at the top followed by the problematic facets. Each facet has a two-digit number. The X0’s indicate more general statements of student ideas. Often these are followed by more specific examples, which are coded X1 through X9. For example, the broad learning goal facet is coded as 00. The learning goal is followed by more targeted goal facets, which are coded as 0X and indented beneath the broader goal facet.

Problematic facets begin with the numbers 2X through 9X. Problematic facets are roughly ranked from *least* to *most* problematic in a cluster, with higher facet numbers (e.g., 7X, 8X, 9X) representing the most problematic ideas.

Goal Facets

- 00 Rocks and soils break down (weather) through chemical and physical processes of interaction with Earth's atmosphere.
- 01 Physical process weathering can happen by rocks rubbing together (through abrasion), by rocks being split apart (when plants grow or water freezes in cracks or holes in rock), or by rocks expanding or contracting (through heating and cooling).
- 02 Chemical process weathering can happen when chemicals in the rocks go into solution or when they combine with other chemicals in the air or water.
- 03 The effects of weathering typically take a long time before they can be observed (at least several decades).
- 04 Weathering may result in the wearing down of rocky landforms.

Problematic Facets

- 20 Students think that only weathering affects landforms and so all landforms eventually will become flat.

- 30 Students think that the power, force, and/or pressure of wind and water always have an immediate impact on rocks and landforms.

- 50 Students overgeneralize water's impact on weathering.
 - 51 For example, students may think that water alone is enough to shape rocks.
 - 52 Students think that only water has to be present for chemical weathering to occur. For example, students do not understand that oxygen in the air is also needed for rocks to oxidize.

- 80 Students confuse weathering and erosion.

- 90 Students think that rocks do not change over time/are the same as they have always been.

Goal Facets

- 00 Landforms change naturally over time when more material is removed from an area than supplied to the area (erosion) and when more material is supplied to an area than is taken away (deposition).
- 01 The force of gravity causes rocks/particles to migrate toward the lowest surface possible. Material tends to accumulate where the land is flatter.
- 02 Moving water, and to a lesser extent, wind, act to transport Earth's particles from one location on the landscape to another.
- 03 Other things being equal, the heavier/bigger the particles, the slower they will be moved by water or wind.
- 04 Other things being equal, the faster and the greater the volume of flowing water or moving air, the faster the water or air will move the particles.

Problematic Facets

- 30 Students think that only water causes changes to landforms.

- 40 Students do not recognize the role of gravity in erosion.
 - 41 All sediment travels the same speed and distance regardless of slope.
 - 42 Deltas form because water needs to room to flow and has space to flow into the ocean.
 - 43 All sediment in rivers ultimately ends up in the ocean.

- 60 Students think that the effects of erosion are always immediate.

- 70 Students think that erosion only happens due to large-scale catalysts (e.g., floods, hurricanes).

- 80 Landforms are only destroyed (not created) by erosion.

- 90 Students confuse weathering and erosion.
 - 91 Students think that weathering and erosion are one process.
 - 92 Students think that erosion is the breaking down of rocks.

