

# Developing Learning Progressions in Earth and Space Science as a Tool for Teacher Professional Development and Student Learning

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# Summary

- Focus on Earth and Space Science
- Urban and Rural Schools in PA
- Teachers and Educational Leaders
- Multi-year Professional Development
- Learning Progressions

# Student Success

Conceptual understanding - movement toward a deep and rich understanding of a big idea in science described in the upper anchor.

(1) Learning progressions

(2) Standardized exam scores

# Student Success

Affiliation for Science - increased appreciation of the value of earth and space science as a field of study.

(1) Increased enrollment

(2) Students continuing in science

# Student Success

Learning progressions and assessments, especially formative assessments, can be used together to not only evaluate students' current state of understanding, but also to get a sense of their trajectory, both back into the past and forward into the future.

# Learning Progression

A learning progression can be visualized as a map of students' conceptual understandings across grade levels around a big idea in science.

# Learning Progression

*Upper Anchor* - a socially defined goal for what we want our students to understand to be considered scientifically literate within our target concept .

# Learning Progression

*Student Conceptions* - these are empirical, collected from students' actual conceptions. Relationships between normative conceptions, misconceptions, partial conceptions, and preliminary conceptions are hypothesized.



# Learning Progression

Learning progressions are intended to be descriptive, compact, coherent and incomplete.

# Energy

The earth's useable energy manifests itself in a variety of forms, some of which can be harnessed for human use. Interactions between forms of energy, including imbalances resulting from human use of resources, can be explained via the law of conservation of energy.

# Plate Tectonics

Large-scale motions of both solid and near-solid earth materials can be explained as a natural consequence of the initial formation of the planet from an array of meteorites, the subsequent differentiation of the planet into chemically distinct units (crust, mantle, core), and the continual transfer of heat from the interior of the planet to the surface.

# Solar System Astronomy

Astronomical phenomena observed from an earth-based perspective (such as the patterns of apparent daily motion, seasonal changes, and the phases of the moon) can be explained using the earth's rotation and tilt, the earth's orbit around the sun, and the moon's orbit around the earth.

# Climate (Change)

Earth's climate is a dynamic system that can be explained as the result of the redistribution of energy, mass and momentum around the globe. The climate system involves and responds to interactions between the geosphere, biota, the atmosphere and oceans, and to internal (e.g. greenhouse gases) and external (e.g. solar energy) drivers that operate over a wide range of temporal and spatial scales.

# Professional Development

Gather preliminary data in spring 2011

- student work samples from assessments developed by the research group
- video of classroom practice.

# Professional Development

Year-long and content-focused

- develop learning progression
- develop of curricular activities and formative assessments

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