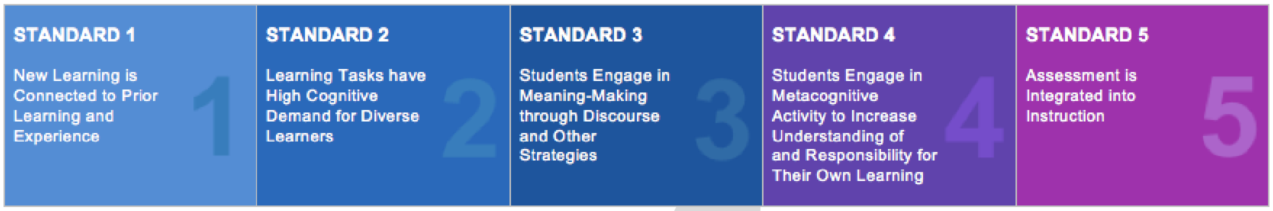
Nevada Educator Performance Framework

A Guide for SCIENCE Educators



Standard 1: New Learning is Connected to Prior Learning and Experience

Indicator 1 - Teacher activates **all** students' initial understandings of new concepts and skills

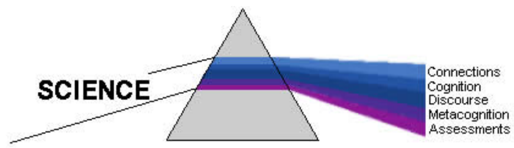
Indicator 2 - Teacher makes connections explicit between previous learning and new concepts and skills for **all** students

Indicator 3 - Teacher makes clear the purpose and relevance of new learning for **all** students

Indicator 4 - Teacher provides **all** students opportunities to build on or challenge initial understandings

General Examples of Science Classroom Strategies:

- Interactive Science Notebooks
- Big Questions
- Student Generated Models (Representations)
- Elicit Student Prior Knowledge
- Connect Topics to Student Relevance



Key Ideas from Theory and Research:

- Learners select and transform information using existing cognitive structures – *schemata* – that enable them to organize knowledge and experiences, and apply their knowledge to new situations (Anderson, 1977; Bruner, 1966; Rumelhart & Norman, 1978, 1982).
- Experts have extensive stores of knowledge and skills, but most importantly they have efficiently organized this knowledge into well-connected schemata (e.g., Chi & Roscoe, 2002; Newell, 1990). It is this "organization of knowledge that underlies experts' abilities to understand and solve problems" (National Research Council, 2005, p. 15).
- Prior knowledge itself does not guarantee its usefulness in learning new concepts unless it is activated in an appropriate context prior to presentation of new knowledge (e.g., Bransford & Johnson, 1972; Chiang & Dunkel, 1992).
- In situations where students' prior knowledge is not engaged and preconceptions are not revealed, students often retain new information long enough to perform well on tests, and then revert back to their preconceptions, correct or not (National Research Council, 2000).
- To connect new learning with prior knowledge, teachers need to be able to take account of the social and cultural prior knowledge with which students enter schools (e.g., Cazden, 2001; Gee, 1989).
- Multiple modes, forms, and methods should be used to get a complete characterization of students' prior knowledge (Valencia et al., 1991).

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Key Practice Examples for a Science Classroom:

Indicator 1 Example:
Ask students to actively engage in Big Questions, pre- and post-instruction.

Ask students conceptually based questions (Big Questions) about the topic prior to the start of the unit or lesson. Have them record the Big Question in their interactive notebook and respond to it with what they currently understand. At the close of the lesson or unit of instruction, prior to summative assessment, ask students to readdress the Big Question in their interactive notebooks, and after responding to the Big Question, describe how their ideas have changed, remained the same, and why.

Example Big Questions:

- Physical Science – What is the relationship between temperature and molecular motion of a solution?
- Life Science – What is the relationship between cell size and the rate of diffusion?
- Earth and Space Science – What is the relationship between Earth's surface temperature and the angle of insolation?
- Engineering – What is the relationship between iterations of a design and the reliability of a product?

Indicator 2 Example:
Ask students to model the connections among science concepts, pre- and post-instruction.

Ask the students to create representations in their interactive notebooks of the relationships among science concepts that will be presented in the lesson or unit. Explicitly ask the students to refine their representations throughout the lesson or unit of instruction (recreating every time). At the end of the lesson or unit of instruction, ask the students to complete a final representation to compare with representations from past lessons or units of instruction. This can be done using diagrams, Concept Maps, some Thinking Maps, etc.

Example unit concepts:

- Physical Science: Heat, Temperature, Energy, Thermal Expansion, Specific Heat, Kinetic Energy, Molecular Motion
- Life Science: Cell Membrane, Cell Wall, Diffusion, Molecular Motion, Phospholipids, Transport
- Earth and Space Science: Radiant Energy, Heat, Convection, Conduction, Radiation, Axis, Specific Heat, Greenhouse Gases, Atmosphere
- Engineering: Design, Iterative product development, Criteria, Constraints, Risk Mitigation, Components

Indicators 3 & 4 Example:
Ask students to own their understanding of the relevance of science concepts, pre- and post-instruction.

Ask students, after a brief introduction into the lesson or unit of instruction, to record why they think the science concept being discussed is important to know in their interactive notebook. Specifically, ask students where they have seen the science concept of the lesson or unit of instruction in nature, used in technology, in their life, and why they think it is important to learn. Ask students to revisit their answers at the end of the lesson or unit of instruction and describe how their original ideas have or have not changed and why.