SCIENCE

Oregon

GRADE	SCORES		TOTAL SCORE
F	Content and Rigor	1/7	2/10
	Clarity and Specificity	1/3	

REPORT CARD

Content & Rigor	**0.8**
Scientific Inquiry & Methodology	2
Physical Science	2
Physics	0
Chemistry	0
Earth & Space Science	1
Life Science	0
Clarity & Specificity	**0.5**

Average numerical evaluations

Overview

At twenty-six pages, Oregon's *Content Standards* is relatively short, but the scientific content is even briefer, confined to a mere three pages. Brevity, in this case, is the soul of failure. Worse, it is essentially a cop-out. No statewide or local assessments could possibly be constructed on the basis of such sketchy information, nor could the meager content presented serve even as a strong foundation upon which a comprehensive curriculum could be built.

Organization of the Standards

Oregon offers science standards for each grade, K-8, and then for high school as a grade band. Within each grade, Oregon's science learning objectives are divided first into four "core standards" (commonly thought of as strands). Two of these core standards—structure and function, and interaction and change—cover "content knowledge." The remaining two—scientific inquiry, and engineering design—cover "process skills." These standards are explicitly intended to replace the traditional disciplinary categories, which are physical science, life science, earth and space science, and scientific inquiry.

Each of the four standards is then further explained by a series of learning objectives. Each learning objective is labeled with a P (physical science), L (life science), or E (earth and space science) to explain to which science discipline it relates.

Content and Rigor

The Oregon standards that address the three core content areas—physical science, life science, and earth and space science—consist of three pages, one for each content area. This means that a single page covers the totality of what Oregon students are expected to learn about each discipline in thirteen years of schooling.

We are told on page two that content specifications for the science standards will be developed in the future. Absent such a document, however, there is no way to know what Oregon expects its students to know and be able to do.

Document(s) Reviewed

- *Oregon Science K-HS Content Standards*. 2009. Accessed from: http://www.ode.state.or.us/search/page/?=2560

Scientific Inquiry and Methodology

The document proclaims that "it is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication." Yet no attempt is made to connect the process standards with content. History of science receives scant attention and is disconnected from all other matters.

Nor is there any real progression of content or rigor from grade to grade. In fact, in many cases, all that seems to be changing across grades is wording: Fifth graders are expected to "identify questions that can be tested" while the following year they "propose questions or hypotheses that can be examined through scientific investigation." More syllables, perhaps, but the idea is the same.

In 2005, we called Oregon's science process standards "perfunctory" and wrote that "their development in higher grades suggests little expectation of students' growth."[1] Sadly, the 2009 standards are equally poor.

Physical Science/High School Physics/High School Chemistry

Oregon provides no standards for high school physics or chemistry courses. Indeed, the word "chemistry" occurs nowhere in the document, and the word "physics" appears only in the name of the Oregon Physics Teachers Association.

There is some meager treatment of physical science, but even those standards omit many important topics, including: moles, balancing equations and stoichiometric calculations, gases, solutions, acids/bases/redox, mixtures, and equilibrium.

Oddly, the last item in the physical science standards asks students to "apply the laws of motion and gravitation to describe the interaction of forces acting on an object and the resultant motion" (high school). But this must logically be learned prior to nearly everything else in physics. And the fundamental principles of conservation of mass and energy are the two items immediately preceding the section on motion and gravitation. Indeed, six standards, written on eleven lines, cover the whole of high school (or is it junior high school?) physical science. How such Spartan attention could conceivably be sufficient in the eyes of the standards-writers is unfathomable. A Shakespearean sonnet takes up more ink.

[1] Paul R. Gross, *The State of State Science Standards 2005* (Washington, D.C.: Thomas B. Fordham Institute, 2005), http://www.edexcellence.net/publications-issues/publications/sosscience05.html.

Earth and Space Science

Once again, solid science content is notable only in its absence in this subject area. A string search does not turn up terms like plate, mountain, earthquake, volcano, convection, heat, seafloor spreading, mineral, rock, unit (except as in "instructional unit"), or theory. All of cosmology, solar system history, and planetary astronomy—that is, all of astronomy at every scale—is telescoped into the single sentence: "Describe how the universe, galaxies, stars, and planets evolve over time" (high school).

Life Science

The life science coverage is consistent with that of the other sciences. We have such sweeping generalities as these in fourth grade:

> **Compare and contrast characteristics of fossils and living organisms.**
>
> **Describe the interactions of organisms and the environment where they live. (grade 4)**

And in like manner in seventh grade:

> **Explain how organelles within a cell perform cellular processes and how cells obtain the raw materials for those processes. (grade 7)**

At the high school level, things get a little more specific, but not very much. Here is the entrée to evolution:

> **Explain how biological evolution is the consequence of the interactions of genetic variation, reproduction and inheritance, natural selection, and time. (high school)**

This would be a fine start, but there is absolutely no expansion of the five global ideas contained in this single sentence.

Oregon scrapes the bottom, earning a content and rigor score of one out of seven. (See Appendix A: Methods, Criteria, and Grading Metric.)

Clarity and Specificity

To say that the Oregon standards are vague would be a ridiculous understatement. A two-page table titled "Vertical Articulation of the Core Standards" contains two columns, labeled "structure and function" and "interaction and change," which give some promise of content until one reads such empty entries as "living and non-living things move" or "the components and processes within a system interact."

At times, what passes for specifics in the Oregon standards amounts to gibberish. In eighth-grade earth and space science, for example, students are asked to "describe the processes of Earth's geosphere and the resulting major geological events." Students in fourth grade don't have it much better. They are expected to "compare and contrast the changes in the surface of Earth that are due to slow and rapid processes." Each of these standards conveys a pretty big order in a single global (pun intended) sentence.

In life science, students must "describe how asexual and sexual reproduction affect genetic diversity" and "explain how ecosystems change in response to disturbances and interactions." Such universal directives are no more useful in life science than they are in earth and space science.

Succinct this document is. Yet it simply cannot provide the kind of information needed to accomplish any real task of K-12 science education. Oregon's near abdication of the proper functions of science standards leads to its average score of barely one out of three for clarity and specificity. (See Appendix A: Methods, Criteria, and Grading Metric.)