Colorado Academic Standards:
Science Benchmarking Report Summary

COLORADO
Department of Education

Science Alignment Study

Introduction

The 2014 *WestEd Review and Analysis of the Colorado Science Standards* is an evaluation of the Colorado Academic Standards in comparison with high quality state, national, and international standards. This summary describes the research-based processes and protocols used during WestEd's crosswalk of the Colorado Academic Standards in Science (CAS-S) with the Next Generation Science Standards (NGSS) (April 2013), the state of Massachusetts Science and Technology/Engineering Curriculum Framework (October 2006), the State of Virginia Science Standards of Learning for Virginia Public Schools (January 2010), and Finland National Core Curriculum for Basic Education (2004) and Upper Secondary Schools (2003). The findings and recommendations from this review are intended to inform decision-making by the Colorado Department of Education (CDE) during its science standards revision process. Periodic standards review is critical to help ensure that the content (skills, knowledge) students are expected to learn reflects the changing priorities, needs, and values of the state and society more broadly, and continues to prepare students for the challenges they will face in successive grades or post-secondary endeavors.

Methodology

A team of analysts at WestEd used various protocols and processes to conduct a crosswalk between CAS-S and NGSS, and CAS-S and Finland, Virginia, and Massachusetts. The CAS-S is organized into Grade Level Expectations (GLE) articulated across individual grades from preschool-grade 5 and in middle and high school. The unit of analysis and reporting for this step was the CAS-S Grade Level Expectation at each grade and in high school, along with the Evidence Outcomes (EO) and Nature of Science (NOS) statements that accompany each Grade Level Expectation in a content area standard. These three statements were used to interpret the state's intent with regard to the development and application of the knowledge and skills described in the standards.

Each content area standard was reviewed and compared with appropriate Performance Expectations and Science Practices from the NGSS. The general evaluation criteria applied to this review were:

- *Depth & Breadth:* Do the CAS-S GLE and EO statements describe sufficient and appropriate depth and breadth of content within each standard, with respect to comparable NGSS performance expectations? If not, what content is missing? Are the GLE and EO statements free from extraneous content? If not, what content is extraneous?
- *Coherence:* Are the CAS-S GLE and EO statements for each standard situated appropriately within the grade spans, with respect to comparable NGSS performance expectations? Do the GLE and EO statements for each standard begin and end at appropriate points in the content?
- *Rigor:* Do the CAS-S GLE and EO statements describe content and skill expectations of a reasonable and appropriate level for this grade span, with respect to comparable NGSS performance expectations? Do the standards, grade level expectations, and evidence outcomes communicate an appropriate level of rigor?

For each CAS-S GLE and EO statement, analysts independently determined if there was a corresponding NGSS Performance Expectation (PE), and to what degree each statement was aligned to the PE. Rating sheets were used to guide the analysis and reporting of holistic findings. The GLE and EO statements were rated as meeting each criterion using the following holistic designations and scale: "Fully" (F); "Partially" (P); "No" (N).

In addition, Massachusetts, Virginia, and Finland comparisons were intended to serve as a holistic review of the similarities and differences between each set of standards and the CAS-S. Specifically, comparisons were documented for two criteria: *Organization/Structure* and *Content.* Analysts recorded a holistic rating as *Similar* or *Different.*

Findings & Observations for Consideration

Overall Findings

a) CAS-S do not have *engineering practices* included in standards (NGSS and MA do).
b) CAS-S partially integrates Nature of Science (NOS) within evidence outcomes; however it is separate in the standards and not integrated in the GLE statement.
c) CAS-S has conceptual gaps within the elementary standards and NGSS shifts concepts to lower grades. This would be the area most impacted by changes to the standards.
d) CAS-S middle and high school tend to have better alignment with NGSS and MA, however there are differences within the depth and breadth of certain concepts and strands. For example, NGSS has more Physics concepts included in their standards then CAS-S; however, CAS-S has more Biological concepts in their standards than NGSS.
e) CAS-S uses grade specific standards, until high school. Whereas, NGSS uses grade bands (i.e., 6-8 grade standards instead of 6, 7, 8 grade standards).
f) CAS-S has preschool standards, all others do not.

Observations for Consideration

There are numerous areas where noticeable differences between CAS-S and the external referents can be observed. It is in these areas that the most discussion is anticipated in considering revisions to the CAS-S.

1. ***Engineering.*** The most noticeable difference between CAS-S and NGSS and Massachusetts is the inclusion of engineering design throughout the standards, including content and practices. CAS-S offers very little engineering in its current form. If Colorado is to consider adding engineering to the CAS, which would seem appropriate considering the recent national focus on engineering and technology (including the recent addition of Technology and Engineering Literacy to the NAEP assessment portfolio), it has a couple of good models to use.
2. ***Integration.*** A hallmark feature of NGSS is the introduction of Performance Expectations, which integrate the Science and Engineering Practices, Disciplinary Core Ideas, and Cross-Cutting Concepts from the Framework for K-12 Science Education into one integrated target for NGSS-aligned assessments. The CAS-S content area standards are structured in a slightly different way, featuring Grade Level Expectations, Evidence Outcomes, and Nature of Science statements.
3. ***Elementary Gaps and Coherence.*** Alignment of CAS-S and NGSS at the elementary level is particularly problematic in that there are significant gaps in what is presented in each set of standards. Any desire to align CAS-S and NGSS more closely at the elementary grades will require some significant retooling of the content areas covered.
4. ***Middle and High School Depth & Breadth and Rigor.*** There are a number of areas where alignment between CAS-S and NGSS at the middle and high school levels could be improved.
5. ***Human Activity.*** In NGSS, considerable attention is paid to the influence and impacts of human activity on the natural world, including human-developed technology, and the impacts of the natural world on humans. CAS-S covers the role of humans and technology in the natural world to a more limited extent.