

FINAL REPORT ON THE REVISED K-12 SCIENCE STANDARDS FOR THE STATE OF WASHINGTON

David Heil & Associates, Inc. (DHA) supported the Office of Superintendent of Public Instruction's (OSPI) efforts to revise the Washington science standards through a series of activities. These activities included collaborating with OSPI staff and their consultant, Cary Sneider, to plan and conduct a two-day workshop for the Science Standards Revision team (SSRT); reviewing two drafts of the Revised Science Standards; facilitating two meetings of the Washington Science Advisory Panel; and providing summaries of the Panel's comments and feedback. This final report to the Washington State Board of Education (SBE) summarizes the DHA Team's findings from a review of the final draft of the Revised Washington State K-12 Science Standards (dated December 1, 2008). The DHA Team reviewed the document with attention to how well the revised document addresses each of the 11 recommendations that were outlined in the Final Report of the Review of the Washington Science Standards (DHA, 5/7/2008) and endorsed by the SBE.

Recommendation 1. Based on our review of the current science standards for the state of Washington, we recommend the development of a new science standards document.

The SSRT included a wide range of stakeholders, including teachers, curriculum specialists, assessment specialists, university science educators, scientists from the major disciplines, and professionals with experience developing standards. In addition to the diverse range of stakeholders represented on this team, a public input process included feedback from a large number of public and professional stakeholders. As recommended, the team worked to build on the strengths of the Washington Grade Level Expectations (GLEs) for Science. For example, the revised science standards extend the treatment of systems concepts, improve the standards for inquiry, and expand the list of Evidences of Learning (ELs) from the previous version into more fully developed Performance Expectations in the revised document.

Recommendation 2. The new science standards should be a comprehensive K-12 document that sets high expectations for all students.

The revised science standards have been expanded to include grades 11 and 12. The document specifies standards for the Physical, Earth & Space, and Life Science domains for grades K through 11 and identifies standards for the cross-cutting concepts (Systems, Inquiry, and Application) that should be addressed by the end of grade 12. The document notes that this approach was taken to support alignment with the recommendation by the SBE to require all students to complete at least three years of high school science.

Specifically identifying separate content for grade 12 is unnecessary and may prove to be confusing to some educators. In addition, although the document extends the science domain content through grade 11, it does not cover the full breadth of content for the science domains

that is included in the 9-12 National Science Education Standards (NSES). In particular, the content included in the NSES for *Chemical Reactions; Interactions of Energy and Matter; Matter, Energy, and Organization in Living Systems; and Behavior of Organisms* is not present in the revised science standards.

Recommendation 3. The standards should create a vision for the science content, methods of science, and applications appropriate for all K-12 students in the state of Washington.

The revised science standards clearly state the purpose, audience, and vision of the science standards in the Overview section of the document. The overview provides a thorough description of how the standards should and should not be used, outlines how the standards should be used by different audiences (curriculum, assessment, and instructional specialists), and discusses how the standards support the vision for science education in the state of Washington.

Recommendation 4. Implementation of the science standards should result in greater coherence across the full spectrum of the educational system – including curriculum development, selection of instructional materials, professional development, and assessment.

This recommendation primarily addresses the implementation of the science standards. The revised science standards support this recommendation by 1) discussing how the standards should and should not be used; and 2) including both content standards and performance expectations in the document. These efforts are a first step towards the work that OSPI must now do to ensure greater coherence across the science education system. OSPI is encouraged to undertake the development of supporting documents that provide guidance on the development and selection of standards-based instructional materials, professional development, instructional strategies, and assessment strategies that support student achievement of the science standards and the measurement of that achievement.

Recommendation 5. Simplify the organization of the Washington science standards document.

The organization and physical layout of the new document has improved the navigability of the standards. As recommended, content of the science domains is organized by life, earth and space, and physical sciences, and the document includes the same clear delineation of science content, methods of science, and applications that was provided in the previous science standards. The revised standards also employ grade spans rather than grade-levels and provide a more precise delineation of the grade spans in the elementary grades.

Recommendation 6. Increase the clarity and specificity of the Washington science standards document.

The use of undefined scientific vocabulary and jargon in the standards has been reduced, and a glossary has been provided to define scientific vocabulary when used. Verbs have been used effectively in the performance expectations to describe what students should do to demonstrate their achievement of what they know or are able to do.

Following a review of an earlier draft of the revised standards, the DHA Team noted that the clarity and specificity of the standards were sometimes compromised by 1) poor alignment between the content standards and performance expectations; 2) poor wording used to describe the content or performance expectations; and 3) mistakes and inaccuracies in the content descriptions. The final document shows major improvements in these areas. However, the DHA Team has not carried out the extensive editorial review necessary to ensure that these areas have been fully addressed throughout the document. If OSPI has not already done so, we recommend that the entire document be reviewed and edited by a small group of scientists and educators with extensive experience writing content standards to correct scientific inaccuracies and to improve the alignment between the performance expectations and content standards. This should be an editing exercise rather than a re-write that would result in eliminating or adding content to the document.

Recommendation 7. Increase the rigor of the Washington science standards document.

The revised Washington science standards address the recommendation to improve the rigor of the standards by introducing some concepts earlier in the elementary grades, by increasing the level of cognitive demand of the standards, and by establishing learning progressions across grade spans for the standards. The use of Big Ideas as an organizer for the standards has been instrumental in addressing this recommendation. The revised standards are organized by nine Big Ideas in the major domains of science and three cross-cutting domains (Systems, Inquiry, and Applications). The revised standards use the Big Ideas framework to establish a coherent learning progression within each domain.

Recommendation 8. Strengthen the standards for inquiry in the state of Washington.

The inquiry standards in the Revised Washington State K-12 Science Standards are much improved over those in the original document: the document includes linkages to the Washington State K-12 Mathematics Standards; the inquiry standards address the “abilities” of inquiry; and the Overview to the standards clarifies the purpose of the inquiry standards as learning outcomes rather than instructional strategies.

The most notable improvement in the inquiry standards is that the “abilities” of inquiry have been addressed in addition to the “understandings” of inquiry. The DHA Team’s review of the original science standards found that few of the grade span 6-8 or 9-10 GLEs for inquiry

addressed the abilities of inquiry and that none of the K-2 or 3-5 GLEs did so. The revised standards address the abilities of inquiry at every grade level by incorporating into the Performance Expectations statements about how students demonstrate the cognitive abilities of inquiry.

Recommendation 9. Improve the standards for Science and Technology.

The standards for Science and Technology are included under the Application EALR in the revised science standards. The Application standards include both the understandings and the abilities of technological design, along with some NSES Science and Technology in Society content. The performance expectations also include some real-world examples.

Recommendation 10. Develop standards to address Science in Personal and Social Perspectives.

The revised Washington science standards include some NSES Science in Personal and Social Perspectives (SPSP) content within the Ecosystems Big Idea of the Life Science domain and within the Application EALR. Across the grade spans for the Ecosystems Big Idea, some content is included to address the NSES standards of *Types of Resources*, *Changes in Environments*, *Population Growth*, and *Natural Resources*. In addition, the Application EALR includes some content related to *Science and Technology in Society*. The coverage of health content is very limited.

Although an effort has been made to incorporate some SPSP content into the science standards, the revised science standards cover only a small portion of the SPSP content that is included in the NSES. This is unfortunate given that the content outlined in the NSES for SPSP includes concepts related to the emerging topics that future citizens will need to address in the areas of health, energy, and the environment; and because this content is fundamental to Washington's effort to prepare a 21st century workforce.

Recommendation 11. The Washington science standards should reflect the balance and depth of content found in the National Science Education Standards.

As discussed in the Overview to the document, the SSRT sought to avoid the "mile wide and inch deep" phenomena, by eliminating redundancy between grade spans and carefully selecting content that fits within the identified Big Ideas for science. This approach yielded a set of revised science standards that are clearly grounded in the NSES content, but do not directly reflect the breadth and depth of content found in the NSES. In particular, the revised science standards for the 9-11 grade span do not include the full breadth of content that is covered in the NSES 9-12 standards (see Recommendation 2) and they lack most of the SPSP content from the NSES (see Recommendation 10).