



Washington State Board of Education  
Working to Raise Student Achievement Dramatically

## Science Standards Review for the Washington State Board of Education

Presentation to the Board  
May 15, 2008

**DAVID HEIL & ASSOCIATES, INC.**  
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### DHA Project Team

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### Project Overview

November December 2007	January 2008	February March April 2008	May 2008
1. Research and review relevant documents, establish criteria for benchmark selection, summarize preliminary findings.	3. Facilitate the expert review of Washington Science Standards.	4. Analyze and interpret results of expert review and prepare recommendations. 5. Facilitate public input into the Science Standards Review.	6. Present findings and recommendations to the SBE Board.
2. Develop methodology and instruments to support expert review.			



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### Public Input: Online Feedback Survey

- Opened online at WA SBE website April 7<sup>th</sup>; Closed April 21<sup>st</sup>.
- 616 Respondents

Connection to K-12 Science Education	Response Percent	Area of Residence	Response Percent
Parent/Guardian of a K-12th Grade Student	23.2%	Northeast Washington	5.5%
K-12th Grade Student	1.0%	Southeast Washington	5.8%
K-12th Grade Teacher	64.1%	Central Washington	16.2%
School Administrator	4.5%	Northwest Washington	23.5%
District-level Science Specialist	5.7%	Southwest Washington	10.7%
ESD-level Science Specialist	1.6%	Puget Sound	37.2%
Professor of Science or Science Education	5.4%	Not a resident of Washington (enter other location)	1.0%
Other (please specify)	14.4%		



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### Public Input: Focus Groups

**Spokane, April 9<sup>th</sup>:** 10 Educators, 10 General Public Members  
**Wenatchee, April 10<sup>th</sup>:** 8 Educators, 12 General Public Members  
**Seattle, April 15<sup>th</sup>:** 11 Educators, 10 General Public Members

<p><b>General Public Participants</b></p> <ul style="list-style-type: none"> <li>Parents of students K-12</li> <li>Students (9<sup>th</sup>-12<sup>th</sup> grades)</li> <li>Local employers</li> <li>College students</li> <li>Recent high school graduates not attending college</li> </ul>	<p><b>Educator Participants</b></p> <ul style="list-style-type: none"> <li>District Staff</li> <li>ESD Staff</li> <li>Teachers (K-2, 3-5,6-8, 9-12)</li> <li>Principal</li> <li>Higher Education, Science &amp; Science Education</li> <li>Informal Education</li> </ul>
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### Public Input: Focus Groups

#### Educator Groups

<p><b>School Districts Represented</b></p> <ul style="list-style-type: none"> <li>Spokane</li> <li>Mead</li> <li>Wenatchee</li> <li>Eastmont</li> <li>Cashmere</li> <li>Seattle</li> <li>Bellevue</li> <li>Nine Mile Falls</li> </ul>	<p><b>Organizations Represented</b></p> <ul style="list-style-type: none"> <li>WSTA</li> <li>LASER</li> <li>ESD 101 (Spokane)</li> <li>Puget Sound ESD</li> <li>North Central ESD</li> <li>Seattle Pacific University, Physics</li> <li>UW, Science Education</li> <li>Spokane City Lab</li> <li>WSU, Engineering &amp; Technology Management</li> <li>Wenatchee Valley College, Nursing</li> <li>Wenatchee Valley College, Earth Sciences</li> <li>Mathematics, Engineering &amp; Science Achievement Program (MESA)</li> </ul>
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## Public Input: Recommendations to Inform Policy and Implementation Decisions

### Quantitative Results from Online Feedback Survey

Recommendations to Inform Policy and Implementation Decisions						
Recommendation	Strongly Disagree	Disagree	Agree	Strongly Agree	Rating Average	Valid n
1. Develop a new science standards document. (n = 510)	7.5%	14.1%	44.9%	33.5%	3.05	510
2. The new science standards should be a comprehensive K-12 document that sets high expectations for all students. (n = 550)	4.7%	4.4%	36.0%	54.9%	3.41	550
3. The science 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. (n = 553)	5.6%	3.1%	36.7%	54.6%	3.40	553
4. Implementation of the science standards should result in greater coherence across the full spectrum of the education system - including curriculum development, selection of instructional materials, professional development, and assessment. (n = 551)	6.2%	4.0%	33.6%	56.3%	3.40	551
<i>answered question</i>						561

Note. 561 respondents answered this set of items. Respondents who selected "no opinion" for an item were excluded from the analysis for that item.



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## Public Input: Recommendations to Inform Policy and Implementation Decisions

### Major Themes from Online Survey and Focus Groups

#### Build on the strengths of the current science standards.

*We should not lose what is best about our current standards nor the work schools have been doing in the process of aligning coursework to state standards.*  
- Survey respondent

*Teachers across the state are working hard to help their students to know and be able to do what is in the current set of standards. Changing just for the sake of change without a compelling reason will not serve any of us well.*  
- Survey respondent.

*Obviously there are things that can be improved in the document but the thing that comes to mind is what about all of the work that's already been done and all of the school districts that have spent thousands of dollars for kits or for release time to actually put together their own power standards or core standards.*  
- Educator focus group participant



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## Public Input: Recommendations to Inform Policy and Implementation Decisions

### Major Themes from Online Survey and Focus Groups

**Ensure that the standards apply to all students, whether or not the student is college-bound.**

*The standards should be realistically attainable for average, hardworking well-taught 10th grade students who may or may not be college bound.*  
- Survey respondent

*Make them minimum standards... ones that will be beneficial in every-day adult living.* - Survey respondent

*I think [we should expect students to learn the science that is going to get them into college] because a lot of my friends... they're freshmen this year at a four year university or community colleges and because the bar was set too low... they have to take... classes that don't count for college credit, but they still have to pay for it because it wasn't taught in high school.*  
- General public focus group participant, recent high school graduate



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## Public Input: Recommendations to Inform Policy and Implementation Decisions

### Major Themes from Online Survey and Focus Groups

**Focus on providing teachers with support to ensure that students are able to achieve the standards: appropriately aligned curricula, professional development, and effective instructional strategies.**

*Make sure that all districts have access to solid curriculum, supplies, science kits... that will help teach these standards.* - Survey respondent

*The standards are not the problem. The problem is everyone is guessing at how to cover the standards. Why not spend time finding materials that accomplish the standards instead of moving the target?*  
- Survey respondent

*I'm in a small district so I don't have the value of having people with specific content knowledge to help develop the curriculum. And when we're assessed on the standard, that then becomes the target and/or the curriculum. So I don't know how to delineate [the standards] from being the curriculum when it's tested.*  
- Educator focus group participant



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## Public Input: Recommendations to Inform Policy and Implementation Decisions

### Major Themes from Online Survey and Focus Groups

**Balance the need for providing teachers with tools for effective instruction with the need for allowing flexibility in the classroom.**

*Teachers should have the flexibility and the creativity to teach in a manner that fits their unique students as long as the students are learning the content covered in the standards.* - Survey respondent

*Teachers aren't used to giving up their authority on their curriculum.*  
- Educator focus group participant



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## Public Input: Recommendations to Inform the Design and Writing of a New Document

### Quantitative Results from Online Feedback Survey

Recommendations to Inform the Design and Writing of a New Washington Science Standards Document						
Recommendation	Strongly Disagree	Disagree	Agree	Strongly Agree	Rating Average	Valid n
5. Simplify the organization of the Washington science standards document. (n = 496)	2.2%	5.0%	39.3%	53.4%	3.44	496
6. Increase the clarity and specificity of the Washington science standards document. (n = 497)	3.4%	5.8%	35.0%	55.1%	3.42	497
7. Increase the rigor of the Washington science standards document. (n = 493)	6.9%	33.2%	37.7%	22.2%	2.75	491
8. Strengthen the standards for inquiry in the state of Washington. (n = 492)	6.7%	21.5%	43.1%	28.7%	2.94	492
9. Improve the standards for Science and Technology. (n = 482)	4.8%	12.7%	49.4%	33.2%	3.11	482
10. Develop standards to address Science in Personal and Social Perspectives. (n = 468)	9.0%	20.7%	43.2%	27.1%	2.88	468
11. The Washington science standards should reflect the balance and depth of content found in the National Science Education Standards. (n = 503)	4.0%	4.4%	44.9%	46.7%	3.34	503
<i>answered question</i>						505

Note. 505 respondents answered this set of items. Respondents who selected "no opinion" for an item were excluded from the analysis for that item.



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## Public Input: Recommendations to Inform the Design and Writing of a New Document

Major Themes from Online Survey and Focus Groups

**Revise the standards to make the document more user-friendly and to make the standards more clearly defined.**

*The top priority should be making the standards clear so that teachers know what they should be teaching their students. They are so vague now and can be interpreted in so many different ways that each teacher may be teaching something different for the same standard.*  
- Survey respondent

*There needs to be some congruency among all of these documents - reading, writing, math, and science.* - Educator focus group participant



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## Public Input: Recommendations to Inform the Design and Writing of a New Document

Major Themes from Online Survey and Focus Groups

**Focus on depth of content rather than breadth of content. Avoid confusing increased rigor with an increase in the amount of content.**

*Do not add to what we have. Rigor does not mean more.*  
- Survey respondent

*Depth of understanding should be emphasized as opposed to coverage.*  
- Survey respondent

*I am concerned that the Science in Personal and Social Perspectives standards will add standards to a document that we are trying to focus more sharply.*  
- Survey respondent

*I'm hoping that the result of the review is to reduce the total number of objectives and show teachers what to teach in depth.* - Educator focus group participant



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## Public Input: Recommendations to Inform the Design and Writing of a New Document

Major Themes from Online Survey and Focus Groups

**Stakeholders highly value science education as a mechanism for ensuring an informed citizenry and a globally competitive workforce.**

- Critical thinking skills are needed in the workplace.
- Showing students the real-world relevance of science motivates them to achieve the standards.

*Effective citizens will realize the cause and effect relationships that exist in all parts of our world and understand that all the skills and knowledge they gain in school work together to prepare them to participate effectively as adults, parents, consumers, voters...* - Survey respondent

*We need to be competitive with the rest of the world in all areas of science education.* - Survey respondent

*Having science skills is good if you want to do science, but science teaches you how to solve problems... how to learn better... It prepares you for courses beyond science.* - General public focus group participant, recent high school graduate



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

- Washington should assemble a Science Standards Revision Team to incorporate the changes detailed in this report.
- The new science standards document should build on the strengths of the current science standards document.
- The Science Standards Revision Team should include teachers, a curriculum specialist, an assessment specialist, a university science educator, scientists from each of the three major disciplines, a professional with experience developing standards at the state or national level, a math educator who worked on the development of the math standards, and a professional editor.

As they develop the new Washington science standards, the Revision Team should review the recently released Washington State K-12 Mathematics Standards (March, 2008) to create important linkages between the two documents.



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

- The document should be expanded to include grades 11 and 12.
- The document should describe the knowledge, skills, and abilities that all students need to be prepared for post-secondary education.

*All students will complete a rigorous high school course of study and demonstrate the abilities needed to enter a post-secondary education program or career path.*

Washington Learns (2006)



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**3** The science 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 new science standards should be clear in their purpose, audience, and voice.
- The document's purpose should reflect the values of the stakeholders in the state of Washington.

### Science Content Standards

*The specific capacities, understandings, and abilities in science.*

### Science Curriculum

*The structure, organization, balance, and presentation of the content in the classroom.*

Adapted from the National Science Education Standards, pg 22



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**Values Expressed by the Expert Review Panel, the Science Advisory Panel, and Participants in the Public Input Process**

**The standards should:**

- empower educators to work towards improving science education.
- support the use of well-designed curricula.
- set high expectations for students.
- allow teachers the flexibility to use a variety of instructional strategies.

**The standards should not:**

- preclude educators from making local decisions about the instructional strategies that will help their students to achieve the standards.
- be used to limit educational opportunities and course offerings for students who can achieve higher expectations in science.



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**4**

**Implementation of the science standards should result in greater coherence across the full spectrum of the education system - including curriculum development, selection of instructional materials, professional development, and assessment.**

- The standards must not be presented as *the* curriculum.
- Supporting documents are necessary to ensure reliable alignment between science standards, development and selection of instructional materials, professional development, classroom instruction, and assessment.
- Supporting documents should provide guidance on development and selection of standards-based instructional materials, professional development, instructional strategies, and assessment that support student achievement of the science standards and the measurement of that achievement.

**Primary Audiences**  
Curriculum and assessment specialists.

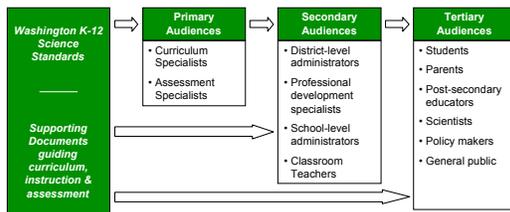
**Secondary Audiences**  
Other professionals working within the science education system such as educational administrators at the school and district levels, professional development specialists, and teachers.

**Tertiary Audiences**  
Stakeholders in the education system and the general public, such as students, parents, scientists, post-secondary educators, business and industry leaders, and policy makers.



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**Implementation Model for the Washington K-12 Science Standards**



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**5**

**Simplify the organization of the Washington science standards document.**

- Reduce the number of organizing elements to improve user navigation of the document.
- Organize the discipline content, currently provided in EALR 1, by life sciences, earth and space sciences, and physical sciences.
- Include the same clear delineation of science content, methods of science, and applications that is provided in the current document.
- Continue to provide standards for grade spans rather than for grade levels, including expanding the high school span to integrate grades 11 and 12.

In contrast to the current Washington standards, both the Massachusetts and the Finland standards, which received the highest ratings from reviewers, as well as the NSES, are clearly organized by discipline content.



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**6**

**Increase the clarity and specificity of the Washington science standards document.**

- The science standards should not depend on scientific vocabulary alone to convey the meaning of an outcome statement of what students should understand or be able to do. Scientific vocabulary within the content statements is acceptable if the term is explained as part of the standard.
- The science standards should provide a more complete, detailed, and specific description of the content to be learned, with special attention to the Life Science content. Minimize the use of external references for defining the science content that is to be learned.
- The verbs used in the standards should specifically delineate what students are to understand/know or be able to do.
- The science standards should use content statements to detail the science content that is to be learned. Model the format of these statements after statements provided in reference documents such as the 2009 National Assessment of Educational Progress and the National Science Education Standards.

**Comparison of Washington and Massachusetts' Physical Science Standards**

**WA GLE 1.3.3, K-2:** Know that water can exist in different states: solid and liquid.

**MA Physical Sciences Standard, Grades PreK-2, #2:** Identify objects and materials as solid, liquid, or gas. Recognize that solids have a definite shape and that liquids and gases take the shape of their container.



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**7**

**Increase the rigor of the Washington science standards document.**

- Some concepts currently introduced in grades 3-5 should be introduced earlier.
- Increase the level of cognitive demand of the standards at all grade spans.
- With the addition of grades 11 and 12, the learning progression across grade spans for each standard should be revised and content redistributed, with special attention to grade spans 6-8 and 9-12.
- Use the most current research on learning progressions within disciplines to establish what students should know and be able to do at each grade span.

In the current document, reviewers found that the application of the verbs associated with Bloom's Taxonomy resulted in unnecessary limitations, and in some cases, lowered expectations.



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

- Devote more attention to the "abilities" of inquiry in addition to the "understanding" of inquiry. Students at all grade levels should be expected to demonstrate the abilities of inquiry.
- Incorporate linkages to the Washington State K-12 Mathematics Standards.
- Provide guidance to clarify the purpose of the inquiry standards as defining learning outcomes for students rather than outlining instructional strategies.

Advisory panel members noted, if students in the state of Washington are to be appropriately prepared to be members of the 21st century workforce, then it is essential that they graduate with critical thinking skills that allow them to conceptualize, apply, analyze, synthesize, and evaluate information based on their observations and experiences.



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## 9 Improve the standards for Science and Technology.

- In addition to the "understandings" of technological design, increase focus on the "abilities" of technological design.
- Provide relevant, "real world" examples to illustrate the concepts that are articulated in the standards.

*In specific industries where Washington has a competitive advantage - global health, aerospace, advanced manufacturing and technology, and other research-intensive industries - the demands on our education system are even greater... Washington has a constitutional duty to provide a basic education for all children from kindergarten through twelfth grade.*

Washington Learns (2006)



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

- Include the Science in Personal and Social Perspectives content found in the NSES.

### Sample Concept From The NSES 9-12 Grade Span Standard For Science In Personal and Social Perspectives

**Population Growth:** *Populations grow or decline through the combined effects of births and deaths, and through emigration and immigration. Populations can increase through linear or exponential growth, with effects on resource use and environmental pollution.*



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

- Focus on fundamental concepts and abilities presented in the National Science Education Standards.
- With the development of the new K-12 document, ensure that the Washington Standards contain all of the content from the NSES, with particular attention to Life Sciences.
- Eliminate areas of redundancy found in the current Washington science standards.

The National Science Education Standards, along with the American Association for the Advancement of Science (AAAS) Benchmarks, remain the primary science standards reference in the field because they were subjected to extensive internal and external reviews during development and they still reflect the nation's best thinking on what students should know and be able to do in science.



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