

December 8, 2008

TO: Teacher Authorization Committee
FR: Jennie Whitcomb
RE: Summary observations comparing state and national Secondary Science Standards

My draft is a sacrificial draft, an initial cut to demonstrate alignment among Performance-Based Standards for Colorado Teachers (PBSCTs), Colorado Science Education standards (8.17s), and National Science Teacher Association standards for secondary science (NSTA, valid until 2010).

Overall, I drew the following conclusions:

The standards for Secondary Science (8.17's) are more closely aligned with NSTA standards than PBSCTs.

PBSCT on literacy and numeracy are *not* reflected in 8.17s or NSTA standards.

The best alignment occurs in the area of content preparation.

The following PBSCTs *are* reflected in the 8.17s and/or NSTA standards:

3.2, 3.3, 3.4, 3.5

4.1, 4.2, 4.3, 4.4

5.5

6.1, 6.2

7.1

8.4, 8.5

The 8.17 and NSTA standards related to safety in the science classroom are *not* reflected in the PBSCTs.

This took me about 3 hours to do, and I won't have time to do other content areas until January.

Performance-Based Standards for Colorado Teachers	Endorsement Standards for CO Teachers	National Science Teachers Association Standards (Valid through 2010)
<p>Standard One: Knowledge of Literacy. The teacher shall be knowledgeable about student literacy development in reading, writing, speaking, viewing, and listening. The teacher has demonstrated the ability to:</p>		
1.1 Plan and organize reading instruction based on ongoing assessment.		
<p>1.2 Develop phonological and linguistic skills related to reading including:</p> <ul style="list-style-type: none"> · Phonemic awareness. · Concepts about print. · Systematic, explicit phonics. · Other word identification strategies. · Spelling instruction. 		
<p>1.3 Develop reading comprehension and promotion of independent reading including:</p> <ul style="list-style-type: none"> · Comprehension strategies for a variety of genre. · Literary response and analysis. · Content area literacy. · Student independent reading. 		
<p>1.4 Support reading through oral and written language development including:</p> <ul style="list-style-type: none"> · Development of oral English proficiency in students. · Development of sound writing practices in students including language usage, punctuation, capitalization, sentence structure, and spelling. · The relationships among reading, writing, and oral language. · Vocabulary development. · The structure of standard English. 		
1.5 Utilize Colorado Model Content Standards in Reading and Writing for the improvement of instruction.		

<p>Standard Two: Knowledge of Mathematics: The teacher shall be knowledgeable about mathematics and mathematics instruction.</p> <p>The teacher has demonstrated the ability to:</p> <p>2.1 Develop in students an understanding and use of:</p> <ul style="list-style-type: none"> · Number systems and number sense · Geometry · Measurement · Statistics and probability · Functions and use of variables 		
<p>2.1 Develop in students an understanding and use of:</p> <ul style="list-style-type: none"> · Number systems and number sense · Geometry · Measurement · Statistics and probability · Functions and use of variables 		
<p>2.2 Utilize Colorado Model Content Standards in Mathematics for the improvement of instruction.</p>		

<p>Standard Three: Knowledge of Standards and Assessment : The teacher shall be knowledgeable about strategies, planning practices , assessment techniques, and appropriate accommodations to ensure student learning in a standards-based curriculum.</p> <p>The teacher has demonstrated the ability to:</p>		
<p>3.1 Design short and long range standards-based instructional plans.</p>		
<p>3.2 Develop valid and reliable assessment tools for the classroom.</p>		<p>Standards 8: Assessment</p> <p>Teachers of science construct and use effective assessment strategies to determine the backgrounds and achievements of learners and facilitate their intellectual, social, and personal development. They assess students fairly and equitably, and require that students engage in ongoing self-assessment. To show that they are prepared to use assessment effectively, teachers of science must demonstrate that they:</p> <ul style="list-style-type: none"> a. Use multiple assessment tools and strategies to achieve important goals for instruction that are aligned with methods of instruction and the needs of students. b. Use the results of multiple assessments to guide and modify instruction, the classroom environment, or the assessment process. c. Use the results of assessments as vehicles for students to analyze their own learning, engaging students in reflective self-analysis of their own work.
<p>3.3 Develop and utilize a variety of informal and formal assessments, including rubrics.</p>		
<p>3.4 Assess, compare and contrast the effects of various teaching strategies on individual student performance relative to content standards.</p>		
<p>3.5 Use assessment data as a basis for standards-based instruction.</p>		
<p>3.6 Provide effective verbal and written feedback that shape improvement in student performance on content standards</p>		
<p>3.7 Prepare students for the Colorado Student Assessment Program (CSAP), Third Grade Literacy Assessment, and other assessments of educational achievement.</p>		
<p>3.8 Ensure that instruction is consistent with school district priorities and goals, the Colorado Model Content Standards, and the 1999 Colorado Accreditation Program.</p>		

<p>Standard Four: Knowledge of Content : The elementary teacher is knowledgeable, in addition to literacy and mathematics in the following content areas: civics, economics, foreign language, geography, history, science, music, visual arts, and physical education. Middle school and secondary content teachers shall be knowledgeable in literacy and mathematics and expert in their content endorsement area(s). The teacher has demonstrated the ability to:</p>		
<p>4.1 Utilize content knowledge to ensure student learning.</p>	<p>8.17 (1) The science educator is knowledgeable about the content of the sciences, and is able to effectively instruct students regarding:</p>	<p>Standard 1: Content Teachers of science understand and can articulate the knowledge and practices of contemporary science. They can interrelate and interpret important concepts, ideas, and applications in their fields of licensure; and can conduct scientific investigations. To show that they are prepared in content, teachers of science must demonstrate that they:</p>
<p>4.2 Enhance content instruction through a thorough understanding of all Colorado model content standards.</p>	<p>8.17 (1) (a) physics, chemistry, biology, earth and space science, environmental science, and applicable mathematics, and</p>	<p>a. Understand and can successfully convey to students the major concepts, principles, theories, laws, and interrelationships of their fields of licensure and supporting fields as recommended by the National Science Teachers Association.</p>
<p>4.3 Apply expert content knowledge to enrich and extend student learning.</p>	<p>8.17 (1) (b) shall have completed an area or areas of concentration in, demonstrate knowledge of and effectively instruct students about one or more areas selected from:</p> <p>8.17 (1) (b) (i) physics to include, but not be limited to: general and experimental physics, mechanics, electricity, magnetism, quantum and atomic physics, sound, and optics.</p> <p>8.17 (1) (b) (ii) chemistry to include, but not be limited to: general chemistry, organic chemistry, inorganic chemistry, analytical chemistry, and physical chemistry.</p> <p>8.17 (1) (b) (iii) biology to include, but not be limited to: general biology, environmental biology, biotechnology, genetics, evolution, human anatomy, ecology, molecular biology, and matter and energy in living systems.</p> <p>8.17 (1) (b) (iv) earth and space science to include, but not be limited to: historical and physical geology, astronomy, environmental science, meteorology, oceanography, geomorphology, stratigraphy, mineralogy, and earth systems.</p> <p>8.17 (1) (b) (v) general science to include, but</p>	<p>b. Understand and can successfully convey to students the unifying concepts of science delineated by the National Science Education Standards.</p> <p>c. Understand and can successfully convey to students important personal and technological applications of science in their fields of licensure.</p> <p>d. Understand research and can successfully design, conduct, report and evaluate investigations in science.</p> <p>e. Understand and can successfully use mathematics to process and report data, and solve problems, in their field(s) of licensure.</p> <p>Note: Not included in this document are the <i>core, advanced,</i></p>

	<p>not be limited to: general chemistry, physics, biology, earth and space science, environmental science, and applicable mathematics.</p> <p>8.17 (2) (b) effectively demonstrate to students, and instruct them about the use of a wide variety of science tools; primary and secondary source materials; print resources; laboratory and natural settings; and technological resources.</p> <p>8.17 (2) (i) demonstrate, for students, the connection between an inquiry-based lesson and a larger conceptual-based module, and the linkage of both to state-approved student science content standards.</p> <p>8.17 (2) (j) effectively demonstrate, and instruct to students about, the linkage(s) between curriculum, instruction, and assessment, as related to state-approved student science content standards.</p>	<p>and <i>supporting</i> competencies outlined in the NRST standards for each of the following disciplines: biology, chemistry, earth/space science, and physics.</p> <p>Standard 4: Issues Teachers of science recognize that informed citizens must be prepared to make decisions and take action on contemporary science- and technology-related issues of interest to the general society. They require students to conduct inquiries into the factual basis of such issues and to assess possible actions and outcomes based upon their goals and values. To show that they are prepared to engage students in studies of issues related to science, teachers of science must demonstrate that they:</p> <ul style="list-style-type: none"> a. Understand socially important issues related to science and technology in their field of licensure, as well as processes used to analyze and make decisions on such issues. b. Engage students successfully in the analysis of problems, including considerations of risks, costs, and benefits of alternative solutions; relating these to the knowledge, goals and values of the students. <p>Standard 6: Curriculum Teachers of science plan and implement an active, coherent, and effective curriculum that is consistent with the goals and recommendations of the National Science Education Standards. They begin with the end in mind and effectively incorporate contemporary practices and resources into their planning and teaching. To show that they are prepared to plan and implement an effective science curriculum, teachers of science must demonstrate that they:</p> <ul style="list-style-type: none"> a. Understand the curricular recommendations of the National Science Education Standards, and can identify, access, and/or
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		<p>create resources and activities for science education that are consistent with the standards.</p> <p>b. Plan and implement internally consistent units of study that address the diverse goals of the National Science Education Standards and the needs and abilities of students.</p>
<p>4.4 Integrate literacy and mathematics into content area instruction.</p>	<p>8.17 (2) (f) effectively instruct students about the connections between and among the various science disciplines and within other disciplines, where relevant and appropriate.</p>	

<p>Standard Five: Knowledge of Classroom and Instructional Management : The teacher is knowledgeable about classroom practice in order to successfully manage time, communications, and record keeping procedures that will support and enhance student learning. The teacher has demonstrated the ability to:</p>		
<p>5.1 Create a learning environment characterized by acceptable student behavior, efficient use of time, and disciplined acquisition of knowledge, skills, and understanding.</p>		
<p>5.2 Apply sound disciplinary practices in the classroom.</p>		
<p>5.3 Apply appropriate intervention strategies and practices to ensure a successful learning environment.</p>		
<p>5.4 Raise the academic performance level of a group of students, over time, to a higher level.</p>		
<p>5.5 Understand the cognitive processes associated with various kinds of learning (e.g. critical and creative thinking, problem structuring and problem solving, invention, memorization and recall) and ensure attention to these learning processes so that students can master content standards.</p>		<p>Standard 5: General Skills of Teaching</p> <ul style="list-style-type: none"> d. Successfully use technological tools, including but not limited to computer technology, to access resources, collect and process data, and facilitate the learning of science e. Understand and build effectively upon the prior beliefs, knowledge, experiences, and interests of students.
<p>5.6 Work in cooperation with library media and other resource specialists in providing student instruction on how to access, retrieve, analyze, synthesize and evaluate information ADOPTED 1/13/00 4 literacy skills into the curriculum to accomplish standards-based learning activities.</p>		
<p>5.7 Accurately document and report ongoing student achievement.</p>		
<p>5.8 Communicate with parents and guardians effectively in order to involve them as participants and partners in</p>		

student learning.		
5.9 Communicate a variety of assessment results, and their implications to students, parents, guardians, professionals, administrators, and the community.		

<p>Standard Six: Knowledge of Individualization of Instruction: The teacher is responsive to the needs and experiences children bring to the classroom, including those based on culture, community, ethnicity, economics, linguistics, and innate learning abilities. The teacher is knowledgeable about learning exceptionalities and conditions that affect the rate and extent of student learning, and is able to adapt instruction for all learners. The teacher has demonstrated the ability to:</p>		<p>Standard 5: General Skills of Teaching Teachers of science create a community of diverse learners who construct meaning from their science experiences and possess a disposition for further exploration and learning. They use, and can justify, a variety of classroom arrangements, groupings, actions, strategies, and methodologies. To show that they are prepared to create a community of diverse learners, teachers of science must demonstrate that they:</p>
<p>6.1 Employ a wide range of teaching techniques to match the intellectual, emotional, and social level of each student, and choose alternative teaching strategies and materials to achieve different curricular purposes.</p>		<p>Standard 5: General Skills of Teaching</p> <ul style="list-style-type: none"> a. Vary their teaching actions, strategies, and methods to promote the development of multiple student skills and levels of understanding. c. Successfully organize and engage students in collaborative learning using different student group learning strategies.
<p>6.2 Design and/or modify standards-based instruction in response to diagnosed student needs, including the needs of exceptional learners and English language learners.</p>		<p>Standard 5: General Skills of Teaching</p> <ul style="list-style-type: none"> d. Successfully promote the learning of science by students with different abilities, needs, interests, and backgrounds.
<p>6.3 Utilize his/her understanding of educational disabilities and giftedness and their effects on student learning in order to individualize instruction for these students.</p>		
<p>6.4 Teach students within the scope of a teacher's legal responsibilities and students' educational rights, and follow procedures as specified in state, federal and local statutes.</p>	<p>8.17 (2) (l) incorporate, into planning, information related to state and federal regulations, legal issues, and guidelines pertaining to scientific materials and specimens.</p>	
<p>6.5 Develop and apply individualized education plans.</p>		
<p>6.6 Collect data on individual student achievement and be accountable for each child's learning.</p>		
<p>6.7 Use specific knowledge of student</p>		

medical conditions and medications and their possible effects on student learning and behavior.		
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<p>Standard Seven: Knowledge of Technology: The teacher is skilled in technology and is knowledgeable about using technology to support instruction and enhance student learning.</p> <p>The teacher has demonstrated the ability to:</p>		
<p>7.1 Apply technology to the delivery of standards-based instruction.</p>	<p>8.17 (2) (e) effectively integrate technology into instructional and assessment strategies, as appropriate to science education and the learner.</p>	<p>Standard 5: General Skills of Teaching</p> <p>d. Successfully use technological tools, including but not limited to computer technology, to access resources, collect and process data, and facilitate the learning of science.</p>
<p>7.2 Use technology to increase student achievement.</p>		
<p>7.3 Utilize technology to manage and communicate information.</p>		
<p>7.4 Apply technology to data-driven assessments of learning.</p>		
<p>7.5 Instruct students in basic technology skills.</p>		

<p>Standard Eight: Democracy, Educational Governance and Careers in Teaching: The teacher recognizes the school's role in teaching and perpetuating our democratic system. The teacher knows the relationships among the various governmental entities that create laws, rules, regulations, and policies that determine educational practices. The teacher has demonstrated the ability to:</p>		
<p>8.1 Model and articulate the democratic ideal to students, including: · The school's role in developing productive citizens. · The school's role in teaching and perpetuating the principles of a democratic republic.</p>		
<p>8.2 Model, and develop on the part of the students, positive behavior and respect for the rights of others, and those moral standards necessary for personal, family and community well-being.</p>		
<p>8.3 Understand and respond to influences on educational practice including: · Federal and state constitutional provisions. · Federal executive, legislative and legal influences. · State roles of the governor, legislature and State Board of Education. · Local school districts, boards of education and boards of cooperative educational services. · Non-traditional and non-public schools, including: charter schools, religious schools and home schooling. · Public sector input from business, advocacy groups, and the public.</p>		
<p>8.4 Promote teaching as a worthy career and describe various career paths in education, including local, state, national, and international options, higher education, public and private education.</p>	<p>8.17 (4) The science educator shall self-assess the effectiveness of instruction, as based on the achievement of students, and pursue continuous professional development, through appropriate activities and coursework, and through participation</p>	<p>Standard 10: Professional Growth Teachers of science strive continuously to grow and change, personally and professionally, to meet the diverse needs of their students, school, community, and profession. They have a desire and disposition for growth and</p>
<p>8.5 Evaluate his/her own</p>		

<p>performance and access the professional development options necessary to improve that performance.</p>	<p>in relevant professional organizations.</p>	<p>betterment. To show their disposition for growth, teachers of science must demonstrate that they:</p> <ul style="list-style-type: none"> a. Engage actively and continuously in opportunities for professional learning and leadership that reach beyond minimum job requirements. b. Reflect constantly upon their teaching and identify ways and means through which they may grow professionally. c. Use information from students, supervisors, colleagues and others to improve their teaching and facilitate their professional growth. d. Interact effectively with colleagues, parents, and students; mentor new colleagues; and foster positive relationships with the community.
	<p>8.17 (2) (g) effectively demonstrate for and instruct students about, the basic elements of the nature of science, including, but not limited to: inquiry, curiosity, discovery, openness to new ideas, and skepticism.</p>	<p>Standard 2: Nature of Science Teachers of science engage students effectively in studies of the history, philosophy, and practice of science. They enable students to distinguish science from nonscience, understand the evolution and practice of science as a human endeavor, and critically analyze assertions made in the name of science. To show they are prepared to teach the nature of science, teachers of science must demonstrate that they:</p>
	<p>8.17 (2) (h) effectively communicate to students about the historical and dynamic nature of science.</p>	<ul style="list-style-type: none"> a. Understand the historical and cultural development of science and the evolution of knowledge in their discipline. b. Understand the philosophical tenets, assumptions, goals, and values that distinguish science from technology and from other ways of knowing the world. c. Engage students successfully in studies of the nature of science including, when possible, the critical analysis of false or

		<p>doubtful assertions made in the name of science.</p> <p>Standard 3: Inquiry Teachers of science engage students both in studies of various methods of scientific inquiry and in active learning through scientific inquiry. They encourage students, individually and collaboratively, to observe, ask questions, design inquiries, and collect and interpret data in order to develop concepts and relationships from empirical experiences. To show that they are prepared to teach through inquiry, teachers of science must demonstrate that they:</p> <ul style="list-style-type: none"> a. Understand the processes, tenets, and assumptions of multiple methods of inquiry leading to scientific knowledge. b. Engage students successfully in developmentally appropriate inquiries that require them to develop concepts and relationships from their observations, data, and inferences in a scientific manner.
	<p>8.17 (2) (k) effectively demonstrate, and instruct to students about, safety considerations in science instruction and in the science classroom, including, but not limited to:</p> <ul style="list-style-type: none"> 8.17 (2) (k) (i) proper use, storage, and disposal or maintenance of biological, chemical, and scientific equipment, and specimens, and is able to: 8.17 (2) (k) (ii) instruct and supervise students in the proper preparation and use of laboratory equipment and materials. 8.17 (2) (k) (iii) evaluate laboratory settings, equipment, materials and procedures, to identify and manage the resolution of potential safety hazards. 	<p>Standard 9: Safety and Welfare Teachers of science organize safe and effective learning environments that promote the success of students and the welfare of all living things. They require and promote knowledge and respect for safety, and oversee the welfare of all living things used in the classroom or found in the field. To show that they are prepared, teachers of science must demonstrate that they:</p> <ul style="list-style-type: none"> a. Understand the legal and ethical responsibilities of science teachers for the welfare of their students, the proper treatment of animals, and the maintenance and disposal of materials. b. Know and practice safe and proper techniques for the preparation, storage, dispensing, supervision, and disposal of all materials used

	<p>8.17 (2) (k) (iv) provide solutions to equipment problems, with the ability to make minor adjustments in the operation of equipment.</p>	<p>in science instruction.</p> <p>c. Know and follow emergency procedures, maintain safety equipment, and ensure safety procedures appropriate for the activities and the abilities of students.</p> <p>d. Treat all living organisms used in the classroom or found in the field in a safe, humane, and ethical manner and respect legal restrictions on their collection, keeping, and use.</p>
	<p>8.17 (3) Field experiences: have completed supervised field experience in an elementary or secondary school at the appropriate grade level(s) for endorsement.</p>	
		<p>Standards 7: Science in the Community</p> <p>Teachers of science relate their discipline to their local and regional communities, involving stakeholders and using the individual, institutional, and natural resources of the community in their teaching. They actively engage students in science-related studies or activities related to locally important issues. To show that they are prepared to relate science to the community, teachers of science must demonstrate that they:</p> <p>a. Identify ways to relate science to the community, involve stakeholders, and use community resources to promote the learning of science.</p> <p>b. Involve students successfully in activities that relate science to resources and stakeholders in the community or to the resolution of issues important to the community.</p>