New Science Standards

A Readiness Assessment for State Boards of Education

April 2015

Center on
GREAT TEACHERS & LEADERS
at American Institutes for Research

NASBE
National Association of
State Boards of Education

New Science Standards: A Readiness Assessment for State Boards of Education

April 2015

Center on
GREAT TEACHERS & LEADERS
at American Institutes for Research

1000 Thomas Jefferson Street NW
Washington, DC 20007-3835
877-322-8700
www.gtlcenter.org

Established in 1946, with headquarters in Washington, D.C., American Institutes for Research (AIR) is an independent, nonpartisan, not-for-profit organization that conducts behavioral and social science research and delivers technical assistance both domestically and internationally. As one of the largest behavioral and social science research organizations in the world, AIR is committed to empowering communities and institutions with innovative solutions to the most critical challenges in education, health, workforce, and international development.

NASBE
National Association of State Boards of Education

333 John Carlyle Street, Suite 530
Alexandria, VA 22314
703.684.4000
www.nasbe.org

The National Association of State Boards of Education is a nonprofit, private association that represents state and territorial boards of education. Our principal objectives are to strengthen state leadership in education policymaking; promote excellence in the education of all students; advocate equality of access to educational opportunity; and assure responsible lay governance of public education.

AIR
AMERICAN INSTITUTES FOR RESEARCH

www.air.org

1147_04/15

This document was created through a collaborative partnership between the Center on Great Teachers and Leaders (GTL Center) at American Institutes for Research and the National Association of State Boards of Education. Please contact the GTL Center at gtlcenter@air.org with any questions or comments. NASBE and the GTL Center cannot endorse the resources and the work of the states featured in this document. Resources are provided in this document solely as additional materials for review and consideration. The National Association of State Boards of Education gratefully acknowledges Carnegie Corporation of New York for its support of the development and publication of this guide.

Contents

Purpose of the Standards Readiness Assessment

State implementation of new standards (revising, adapting, and adopting new standards)[1] is a significant undertaking. Such an effort at the state level requires extensive support, planning, and resources. Implementing new state standards also requires the support of multiple education leaders—governors, legislators, state departments of education, school and district administrators, teachers, and state boards of education (SBEs)—each of whom holds important and varying roles in the education system.

The National Association of State Boards of Education (NASBE) and the Center on Great Teachers and Leaders (GTL Center) aim to support SBEs in the leadership roles they can and do play relative to implementing new science standards such as the Next Generation Science Standards. Indeed, SBEs can, and often do, provide important leadership in setting policies related to state standards, advocating for change, and bringing multiple stakeholders together.

Many states are just beginning to consider whether to modify existing science standards, adapt standards being used in other states, or develop new ones. This document is intended to guide SBEs through this complex process. While many organizations have developed resources to support implementation of new science standards, this document goes beyond others by providing clear examples, resources, and a step-by-step process that SBEs can use to begin this work.

Organization of the Matrix

This document consists of a self-assessment matrix—a Standards Readiness Assessment—as well as guidance and explanations that SBE members can use interactively to help determine their state's overall readiness to adopt and implement science standards. Use the matrix to determine your state's readiness to pursue specific processes and policies that will facilitate science standards adoption and implementation. Its purpose is to help SBEs identify existing gaps and monitor their states' progress toward readiness in each of the process and policy domains described in the assessment. Based on SBE members' answers to the guiding questions, the Standards Readiness Assessment offers action steps to influence or promote their states' readiness for implementing new science standards in each domain. This Standards Readiness Assessment is provided in Part I of this document. Figures 1A and 1B below illustrate seven domains of standards implementation and provide a procedural sample drawn from the matrix.

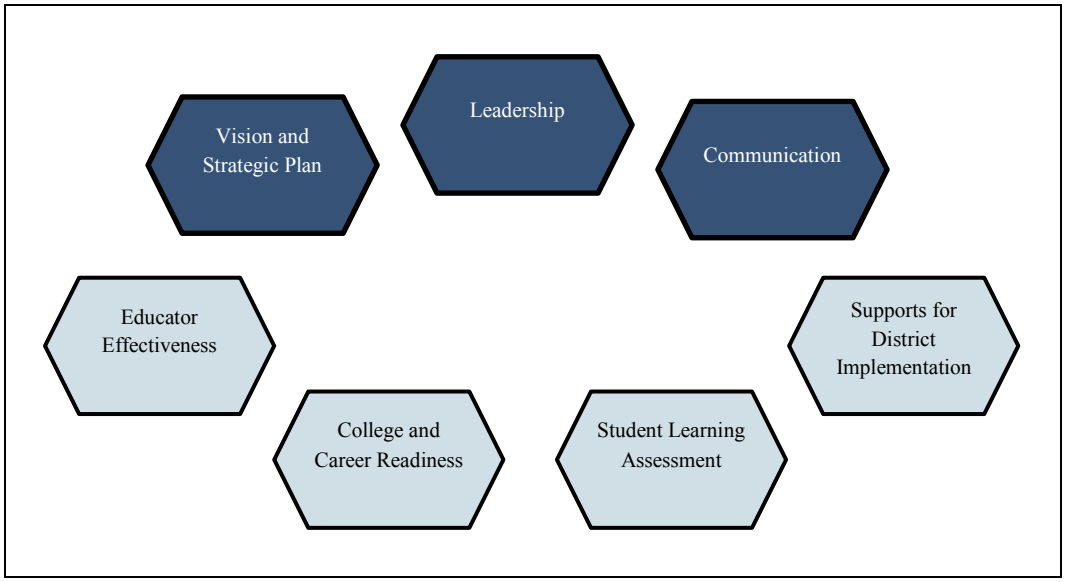
[1] Throughout this document, the term "new standards" represents the results of any of these approaches to implementing new standards.

Figure 1A. Process Domains: Sample from the Matrix.

Process Domains

	Guiding Questions	Y/N/U	If answer is *no* or *unsure*, consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Vision and Strategic Plan	Has the SBE clearly articulated the vision for the new science standards?		▪ Develop a vision for the new standards and connect to existing SBE strategic plan. ▪ Develop a rationale for the focus on standards. ▪ Articulate the SBE's strategy or role in this work.	▪ Lack of political support ▪ Competing political interests ▪ Initiative fatigue and/or fear of something new		2
	Has the SBE identified implementing new standards as a priority?		▪ Work with the SEA to assess the feasibility of implementing new standards, given the political landscape, available budget, state capacity for supporting implementation, and current competing demands placed on districts. ▪ Ask the SEA to identify measurable, expected outcomes of the work. ▪ Ask the SEA to identify student outcome data to be used to assess whether new standards are effective at preparing students for college and careers.	▪ Limited time to develop plan ▪ Limited availability of outcome data ▪ Limited SEA capacity for leading or implementing, supporting, and monitoring work		
	Does the SBE have a plan for reviewing standards and implementation data on a regular basis?		▪ With the SEA, establish a timeline to request regular review of standards and monitoring of standards implementation. ▪ Work with the SEA to identify criteria and outcomes to be reviewed.	▪ Limitations on timelines placed by Elementary and Secondary Education Act (ESEA) waivers, the U.S. Department of Education, or the state legislature ▪ Limited ability to collect and report on outcomes data		

Figure 1B. Seven Domains of Standards Implementation



The self-assessment matrix comprises seven domains as shown in Figure 1B. The first three domains (highlighted in dark blue in the top arc of Figure 1B) are focused on *processes* that can facilitate implementation of new standards. These three process domains include vision and strategic plan, leadership, and communication across multiple stakeholder groups. A focus group of NASBE members, conducted during the development stages of this Standards Readiness Assessment, highlighted these three domains as most critical to successful standards implementation. The remaining four domains, represented in the lower arc of Figure 1B, focus

on key areas of *education policy* that typically need to be reviewed and adjusted (if necessary) to support standards implementation, foster policy coherence, and support implementation.

Each of the seven domains of standards implementation requires a discrete set of actions and plans; but ultimately, each domain affects and interacts with the others. For example, assessment selection may affect the availability of student growth measures planned for use in teacher evaluations; and the vision and strategic plan may have implications for revising other measures of college and career readiness, such as high school graduation requirements or other postsecondary entrance requirements. These domains also align with the recommendations made by the National Research Council's Board on Science Education in its *Guide to Implementing the Next Generation Science Standards* (2015).

The sections that follow include an overview of each domain, state examples, and an explanation and guidance for using the Standards Readiness Assessment.

How to Use This Document

We recommend reviewing the guidance in Part II in conjunction with the Standards Readiness Assessment described in Part I. The guidance is organized around the same critical initial questions for the SBE as the Standards Readiness Assessment in Part I. By reviewing the documents together, SBEs can reflect on the guidance and their readiness to implement new science standards simultaneously.

Part I. Self-Assessment Matrix for Determining Readiness to Reform Science Standards

NASBE and the GTL Center developed this Standards Readiness Assessment to assist SBEs in determining the extent to which their respective states have the requisite elements in place to successfully support the adoption and implementation of new state science education standards. This self-assessment is designed primarily for states in the preadoption and adoption stages of new science standards implementation. However, since the adoption of "new" state science standards will vary across states (i.e., does the state intend to adopt an entirely new set of standards, or does it aim to revise or adapt existing standards?), this self-assessment tool is designed with multiple approaches to standards implementation in mind. Based on a review of research and literature on implementing new standards, NASBE and the GTL Center have identified seven domains as critical to moving forward with the successful implementation of new science standards.

The self-assessment matrix consists of a series of guiding questions for each of the seven process domains and policy considerations for SBE members to address and answer. When completing the self-assessment, SBE members are asked to review each question and respond with an answer of *yes, no,* or *unsure*. If the answer is *no* or *unsure*, SBE members may review the suggested actions and challenges to anticipate as they consider how best to move their individual states forward with respect to readiness. In addition, the guidance for this tool provides clarifying information, profiles examples from other states, and highlights relevant resources to support SBE members' efforts. Links to specific sections of the guidance are included in the far right column of the matrix.

Process Domains

	Guiding Questions	Y/N/U	If answer is *no* or *unsure*, consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Vision and Strategic Plan	Has the SBE clearly articulated the vision for the new science standards?		▪ Develop a vision for the new standards and connect to existing SBE strategic plan. ▪ Develop a rationale for the focus on standards. ▪ Articulate the SBE's strategy or role in this work.	▪ Lack of political support ▪ Competing political interests ▪ Initiative fatigue and/or fear of something new		11
	Has the SBE identified implementing new standards as a priority?		▪ Work with the SEA to assess the feasibility of implementing new standards, given the political landscape, available budget, state capacity for supporting implementation, and current competing demands placed on districts. ▪ Ask the SEA to identify measurable, expected outcomes of the work. ▪ Ask the SEA to identify student outcome data to be used to assess whether new standards are effective at preparing students for college and careers.	▪ Limited time to develop plan ▪ Limited availability of outcome data ▪ Limited SEA capacity for leading or implementing, supporting, and monitoring work		
	Does the SBE have a plan for reviewing standards and implementation data on a regular basis?		▪ With the SEA, establish a timeline to request regular review of standards and monitoring of standards implementation. ▪ Work with the SEA to identify criteria and outcomes to be reviewed.	▪ Limitations on timelines placed by Elementary and Secondary Education Act (ESEA) waivers, the U.S. Department of Education, or the state legislature ▪ Limited ability to collect and report on outcomes data		

	Guiding Questions	Y/N/U	If answer is *no* or *unsure,* consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Leadership	Do key players (e.g., governor, legislators, SEA, teachers, unions, parents, business and industry members) support the new standards?		▪ Identify and recruit key leaders to serve as advocates and champions of the work. ▪ Identify other influencers (business groups, local coalitions, associations and advocacy groups) who can galvanize support. ▪ Raise awareness of why new standards are important. ▪ Identify possible barriers to leadership involvement (i.e., legislation on committee involvement, limited understanding of the need for new standards)	▪ Lack of visible public support from key players ▪ Lack of understanding or information about new science standards		14
	Has the state identified a leadership team to drive the implementation of the new standards and developed a timeline, phase-in strategy, and work plan?		▪ Ask the SEA to recruit science content experts, scientists, community leaders, teachers, and administrators to engage in review of current standards and planning for new standards implementation. ▪ Ask the SEA to review timeline, phase-in, and work plan recommendations by the committee.	▪ Finding time for the leadership team to meet ▪ Providing sufficient and regular reporting to the SBE		

	Guiding Questions	Y/N/U	If answer is *no* or *unsure,* consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Two-Way Communication	Do the SBE and the SEA have a strategic communications plan?		▪ Work with the SEA and the leadership team to create a communications plan that identifies the intended audiences, messages, delivery methods, and persons charged with leading communications.	▪ Matching communications delivery methods to intended audiences		16
	Do the SBE, the SEA, and other key players have a shared set of key messages or talking points?		▪ Collaborate with the SEA to develop key messages or talking points. ▪ Share messages or talking points with key players and other stakeholders.	▪ Ensuring all parties use consistent messaging ▪ Clarifying concerns based on misconceptions about the scope of the work (i.e., standards versus curriculum and instruction)		
	Has the state identified mechanisms for seeking input and gathering feedback?		▪ Identify current methods for seeking input (e.g., public comment period, SBE meetings) ▪ Work with SEA to determine if additional methods for seeking input are needed. ▪ Collaborate with the SEA, unions, and professional organizations to develop a plan for collecting feedback on implementation at regular intervals.	▪ If timelines are limited, gathering sufficient input		

Policy Consideration Domains

	Guiding Questions	Y/N/U	If answer is *no* or *unsure*, consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Supports for District Implementation	Do districts have the curricular, infrastructure, and professional learning supports needed to implement the new standards?		▪ Request from the SEA or standards leadership team a detailed analysis of the impact of new standards adoption and implementation that identifies the following: • Funding required • Necessary changes in curriculum • Infrastructure/physical readiness to implement • Professional learning needs ▪ Ask the SEA to identify funding and expert sources that can support districts in addressing current readiness gaps. ▪ Ask the SEA to develop a list of vetted professional learning providers for districts to engage.	▪ Limited capacity of the SEA to analyze readiness to implement ▪ Limited availability of state resources needed to support districts ▪ Limited time in which to seek additional resources		20
	Do state policies encourage the provision of high-quality professional learning opportunities for teachers and leaders?		▪ Ask the SEA to review, revise, or adopt as necessary new professional learning standards. ▪ Ask the SEA to review current policies that affect teaching conditions needed for effective professional learning. ▪ Revise policies related to professional learning. ▪ Ask the SEA to gather and review professional learning outcome data. ▪ Recommend strategies for addressing gaps in professional learning.	▪ Limited capacity of the SEA and district to implement new professional learning standards ▪ Lack of district awareness of professional development standards and policies ▪ Lack of professional learning outcome data		

	Guiding Questions	Y/N/U	If answer is *no* or *unsure*, consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Assessment	Does the state have a plan for determining whether to revise current state assessments, acquire state assessments already in use elsewhere, or develop new assessments?		▪ Ask the SEA to determine who will conduct the review (e.g., a committee, SEA staff, assessment and content experts from multiple districts). ▪ Ask the SEA for an inventory of assessments currently used in districts and for a list of other available, SEA-approved assessments. ▪ Ask the SEA to consider collaborating with other states and organizations during the assessment review and/or development process.	▪ Backlash from public resulting from assessment fatigue and skepticism about assessments ▪ Costs ▪ Lack of legislative support		24
	Does the state have a clear timeline for including science in the state accountability system?		▪ Ask the SEA to determine the feasibility of including science in the state accountability system. ▪ Ask the SEA to anticipate potential barriers to implementation, and develop an implementation timeline. ▪ Review proposed timeline for including science in the accountability system.	▪ Lack of public support of high-stakes accountability ▪ Misunderstanding and misapprehension based on past reform experiences		
College and Career Readiness	Do the new science standards align with the rigorous expectations of other college- and career-ready standards?		▪ Ask the SEA to develop an alignment chart that includes new standards and other career- and college-readiness standards. ▪ Identify areas of convergence and areas of disconnect among the standards.	▪ Developing mitigating strategies for addressing gaps in standards ▪ Defining what is "career ready"		27
	Will course sequences, including Career and Technical Education (CTE) pathway requirements, dual enrollment requirements, and graduation requirements need to be revised to align with the new standards?		▪ Ask the SEA to convene a committee to review the alignment of new standards, model course sequences, dual enrollment requirements, and high school graduation requirements. ▪ Review recommendations and, as needed, revise policies to address gaps in alignment.	▪ Limited district capacity to implement new sequences or requirements quickly		

	Guiding Questions	Y/N/U	If answer is *no* or *unsure*, consider taking the following actions:	Challenges to Anticipate	Challenges in Our State	Page
Talent Development	Are policies aimed at recruiting, developing, and retaining effective science educators aligned with the instructional demands of the new science standards?		▪ Engage higher education institutions, alternative preparation program providers, science content experts, and districts in conducting a review of teacher preparation programs, licensure requirements, and current program approval and accreditation requirements. ▪ Ask the SEA to determine alignment between current requirements and the skills teachers need to effectively provide instruction on the new science standards. ▪ Ask the SEA to determine the implications of new standards and assessments relative to teacher preparation program accountability measures. ▪ Ask the SEA to determine if the state or districts should collect additional data on the impact of educator effectiveness policies. ▪ Make policy revisions and develop new policies for the transition between old and new assessments, and include those assessments in teacher evaluations. ▪ Request review of the Higher Education Agency to determine alignment between teacher preparation program approval requirements and the teacher skills and content mastery needed to teach to the new science standards.	▪ Need to be strategic relative to which policies are tackled first; revising all policies at once may overwhelm institutions affected by those policies ▪ Need gradual implementation and a plan for supporting educators, programs, and other resources that may be "grandfathered in"		30

Part II. Guidance for Determining Readiness to Reform Science Standards

Vision and Strategic Plan

Has the SBE clearly articulated the vision for the new standards?

Consider what the SBE hopes to accomplish. How will the SBE know if the implementation of the new standards has been successful? How does the vision for the new standards fit broadly within the state's overall science, technology, engineering, and mathematics (STEM) agenda and other college- and career-ready efforts? Achieve (2013) identifies four common reasons states give for implementing new science standards: to produce skilled graduates to fill the growing number of STEM jobs, to produce graduates who can compete for jobs nationally and internationally, to increase diversity in the STEM workforce, and to prepare all students to be informed citizens and knowledgeable consumers.

> "A shared aspiration will be important in your state's efforts and, when the going gets tough, to persevere in implementation. Developing an aspiration, including the benefits of improved science education and performance for your state's students, will force you to develop your own deeper understanding of the [new standards]—one that will anchor decisions about strategy and implementation down the road." (Achieve 2013)

SBEs can help their states assess the feasibility of implementing new science standards by considering the political landscape as well as the capacity of the state and the districts to do this work. Ask questions such as: *What challenges does the SBE anticipate, and how might they impact the realization of your vision?* SBEs can use the matrix in Part II to identify and address these key questions.

Has the SBE identified implementing new science standards as a priority?

Review the current SBE strategic plan. Has the SBE already integrated the implementation of new science standards into their strategic plan as a priority? For example, the Delaware Board of Education identified Common Core State Standards and assessments and 21st century skills as being integral to the overarching goal identified in its strategic plan (see State Spotlight: Delaware for more detail). Integrating the implementation of new science standards into the strategic plan can help ensure continuity of priorities even as SBE members change. Likewise, it can help SBEs better showcase their priorities to SEA leadership.

State Spotlight: Delaware

Although currently focused on the Common Core State Standards, the Delaware Board of Education integrated standards reform throughout its 2011–2015 strategic plan. The overarching goal of the strategic plan is the following: "Using high standards and rigorous expectations for students, teachers, and leaders, all Delaware students graduate ready for college, career, and citizenship" (Delaware State Board of Education, n.d.). The board identified four focal areas, one of which is Common Core State Standards and Assessment. The board includes the following:

- a rationale for college and career readiness standards
- expected outcomes as a result of new standards
- the board's strategies
- intended board actions
- accomplishments to date

In addition, the strategic plan focuses on STEM education in the focal area of 21st century skills. One of the SBE strategies identified in this part of the strategic plan is to encourage STEM education and careers.

When the SBE adopted a revised state code (education rulemaking and laws), it charged the Delaware Department of Education (DDOE) with creating and disseminating a timeline for implementation of the Next Generation Science Standards. The DDOE convened a Next Generation Science Standards implementation leadership team made up of DDOE staff, district leaders, a university professor, and an education liaison from DuPont. This team, with support from the Delaware Science Coalition Steering Committee membership, created a detailed implementation plan. This plan included action plans for communication, assessment, instructional practices, curricular resources, and infrastructure.

Does the SBE have a plan to review standards and implementation data on a regular basis?

Establishing criteria for review of the effectiveness of standards and setting a regular schedule for their review can help ensure that assessing the impact of standards continues to be a priority even as SBE members change. For example, in Wyoming, legislation requires SBEs to review standards every five years (see Sample Legislative Language: Wyoming, below, for more details.) In Kansas, updates on science standards implementation appear regularly on the board of education meeting agenda. At least quarterly, a science consultant with the state's department of education updates the board on standards implementation.

Sample Legislative Language: Wyoming

"(c) The state board shall perform an ongoing review of state board duties prescribed by law and may make recommendations to the legislature on board duties. In addition and not less than once every five (5) years, the board shall evaluate and review the uniformity and quality of the educational program standards imposed under W.S. 21-9-101 and 21-9-102 and the student content and performance standards promulgated under paragraph (a) (iii) of this section, and shall report findings and recommendations to the joint education interim committee of the legislature on or before December 1 of the year in which the review and evaluation was undertaken. The joint education interim committee shall report its recommendations, based upon findings and recommendations of the state board, to the legislature during the immediately following legislative session." (W.S. 21-2-304 [c)])

As part of their review of standards and their implementation, SBEs can do one or more of the following:

- Request that the SEA reviews measures of science performance. Potential measures may include student performance on state and national science examinations; workforce development measures; percentage of graduates entering a STEM field; dropout and failure rates in introductory postsecondary science courses; and measures of dual enrollment, Advanced Placement, and International Baccalaureate enrollment. For example:
  - How are students performing today compared with how they have performed in the past? How does performance differ across student subgroups?
  - Which districts and schools are outperforming others? What subgroups of students are outperforming others?
  - How does the state's performance compare with the performance of other states and countries?
- Request that the SEA reports on the progress of implementation.
  - How many districts have fully implemented the new science standards?
  - How has the SEA supported district efforts to date?
  - Do all students have equitable access to high-quality and rigorous science courses?
  - What challenges do districts report related to the new standards? Are policy revisions or technical assistance needed to better support districts and schools?
- Review feedback from educators and request presentations from science and industry experts on whether the standards need to be updated.
  - Are the standards easy to understand and use?
  - Have there been new developments in science that are not reflected in the current standards?
  - Do students need different or additional skills in order to be prepared to enter the workforce?

SBEs may not see changes in teaching and learning immediately given the gradual nature of implementation, but having a plan for reviewing outcomes on a regular basis prior to adoption can facilitate discussion about how to adapt and improve implementation efforts based on available data.

Additional Resource

Workbook Exercise 4—This exercise from the *Next Generation Science Standards Adoption and Implementation Workbook* may prove useful in walking SBEs through the process of developing a vision for the work.

Leadership

Do key players (e.g., governor, legislators, SEA, teachers, unions, parents, business and industry members) support the new standards?

State implementation of new standards requires leadership to support and coordinate multiple actors and organizations. Therefore, building a coalition of support among the governor, legislators, SBE members, SEA staff, and educators can provide a strong foundation for implementation. Legislators and SBE members have emphasized that standards adoption and implementation is easier when multiple key leaders support and coordinate efforts (Yoo 2012). Garnering support from key leaders—the governor, legislators, and SEA staff—to the greatest extent possible is critical to presenting key stakeholder groups with a "united front." As in all reform efforts, there will be those who are skeptical or opposed to moving forward. Therefore, providing transparency in the process, building broad understanding and support among key leaders and practitioners such as business coalitions or important professional organizations, and informing all stakeholders of the importance of the initiative and its intrinsic value to improving teaching and learning in their state will be vital.

State Spotlight: State of Washington

Before adopting the Next Generation Science Standards, a leadership team made up of local educators, Office of the Superintendent of Public Instruction representatives, and university staff developed a comparison of the NGSS and the 2009 Washington Science Learning Standards. This document included an alignment chart as well as general, grade-level, and subject transition advice. The state's preadoption process also included a bias and sensitivity review of the new standards, a period of gathering input from the public and a variety of stakeholders (including the SBE), and time for the state legislature to understand the changes (OSPI Communications 2013) . In October 2013, the Washington State Board of Education adopted the Next Generation Science Standards, known in the state as the Washington State 2013 Science Learning Standards. The SBE had a broad and vocal coalition of support, including Governor Jay Inslee, Washington State Superintendent of Public Instruction Randy Dorn, and 2013 National Teacher of the Year Jeff Charbonneau. Governor Inslee and Superintendent Dorn announced jointly the adoption of the new standards, and Jeff Charbonneau published an editorial in the *Seattle Times*. In March 2014, Superintendent Dorn provided a commentary to NASBE that clearly articulated the reasons Washington State adopted the Next Generation Science Standards.

Has the state identified a leadership team to drive the implementation of the new standards and developed a timeline, phase-in strategy, and work plan?

Garnering the support of highly visible and influential leaders in the state is important, but a leadership team that can drive the actual implementation of new standards is also necessary. It is important that the leadership team includes members with a strong science background and knowledge to help guide implementation planning. The nonprofit organization Achieve recommends that SEAs identify leadership team members with the following capabilities (Achieve 2013):

- strong problem-solving skills
- interpersonal and relationship management skills

- knowledge of current science standards
- capacity to contribute to the development of adoption and implementation plans
- oversight and management experience and skills
- knowledge of the SEA's priorities and timing for action
- understanding of how standards fit within larger policy and political landscapes
- communication skills and influence

The leadership team should also have a diverse representation of experiences and expertise, including current science educators and professionals. SBEs can work with SEA leadership to consider and identify team members, including (Achieve 2013):

- SEA staff members
- members of professional standards boards
- higher education representatives
- legislators or legislative aides
- governor's office representatives
- business community members
- parents or members of parent organizations
- educators from leading schools and districts

Typically, the SEA is responsible for convening and facilitating this type of leadership team. The SBE, however, may play an important role in providing team oversight and guidance. For example, the SBE can review the timeline and recommendations from the leadership team with the following questions in mind: Does the implementation timeline include key milestones and a plan for a phased rollout and implementation of the standards? Is the work plan sufficiently detailed?

State Spotlight: Maryland

In June 2013, the Maryland State Board of Education adopted the Next Generation Science Standards and an accompanying implementation plan. The SBE designated a strategic leadership team to oversee the implementation process and drafted a vision statement to guide the work. Working in partnership with the Maryland State Department of Education, the SBE developed a preliminary implementation timeline for the development of "preK–12 scope and sequence of courses, review of high school courses, provision of instructional models, provision of technical assistance, and alignment of local curricula to state documents" (Eberle 2014a, 2). The department of education then developed talking points for communication purposes and an evaluation strategy to determine if the Next Generation Science Standards implementation plan was being executed with fidelity. The state will implement the new standards during the 2017–18 school year.

Additional Resources

Exercise 1: Delegate Your Strategic Leadership Team—This exercise in the *Next Generation Science Standards Adoption and Implementation Workbook* (Achieve 2013) can help SBEs and SEAs identify a leadership team to spearhead the process for new standards adoption.

Chapter 1: Designate a Strategic Leadership Team, Review Your Capacity for Adoption and Implementation, and Create a Timeline for Adoption and Preliminary Implementation—This chapter of the *Next Generation Science Standards Adoption and Implementation Workbook* (Achieve 2013) provides guidance that can inform part of the work needed to implement Next Generation Science Standards (i.e., assembling a strategic leadership team and preparing a timeline for implementation).

Communication

Do the SBE, the SEA, and other key players have a shared set of key messages or talking points?

State implementation of new standards requires not only the introduction of new processes or policies but also the management of change. Effective communication is an important component of change management. States can facilitate effective communication practices by providing a clear rationale for adopting new standards, sharing the new standards, and making efforts to gain the support and buy-in from multiple stakeholder groups, including potential critics, science experts, business leaders, and other prominent stakeholders. The SBE can support the change management process by collaborating with these stakeholders and the SEA to develop a set of basic talking points that describe the new science standards and how they align with the state's education goals. These basic talking points can provide a shared language among leaders who serve as spokespeople for the standards, help prevent misunderstanding and confusion about the standards, and promote common understanding among key stakeholder groups.

Do the SBE and the SEA have a strategic communications plan?

The SBE can collaborate with the SEA and the leadership team to identify audiences the state must reach in order to build buy-in for implementing new standards. For each audience, the SBE can work with SEA leadership to identify potential spokespeople from within their networks. The ultimate goal is to develop a "coalition of champions"—a broad group of stakeholders comprising members of the leadership team as well as stakeholders from advocacy organizations, parent organizations, philanthropic entities, student groups, and civic groups (Colby and Stenos 2014).

Key Resource from NASBE

NASBE members can access a communication workbook that helps SBE members craft messages pertinent to the Next Generation Science Standards. Readers must log in to access the information.

The SBE can facilitate the work of this coalition by working with SEA leadership to develop key messages and an associated communications plan. The key messages can be incorporated into a plan that identifies the intended audience, the

specific messages to be communicated to that audience, the delivery method(s), the role of the spokespeople, and who is in charge of the communication. Although the theme of the messaging should be consistent across intended audiences, the delivery and specificity of each message may vary slightly. For example, educators will want to know how the transition to new science standards will affect their work; parents and community members will want to know how the new science standards will affect their children and their achievement; and policymakers will want to know how the new standards will be funded and how representatives can respond to questions and concerns that may be raised by their constituents (Achieve 2012).

A communications plan in a high-stress environments should strive forthe following:

- concise, clear, and empathetic communication;
- at most three messages at a time ;
- simple messaging ;
- a plan for preparing spokespersons for media opportunities;
- op-eds to support key milestones (i.e., adoption, implementation planning, rollout, scale-up) ;
    - identification of who should write op-eds, mindful of the public trust factor. For example, if the governor has limited political capital because of a lack of public support, consider having a teacher of the year or a National Board Certified science teacher write the op-ed.
- sufficient capacity to devote to engaging via social media, with a plan for addressing negative responses ;
- engagement of standards-supporting business leaders, STEM employers, museums, teachers, university researchers, and leadership team members in communication efforts ; and
- a plan to assess the impact of the overall communications plan and adjust strategies as needed.

State Spotlight: Rhode Island

Before the release of the final version of its standards, Rhode Island launched extensive communications efforts. From August 2011 to April 2013, Rhode Island state leaders communicated about the Next Generation State Standards using listservs, websites, and presentations. During 2013–14, Rhode Island continued to build stakeholder awareness through presentations, webinars, and a dedicated Web page. One part of these efforts was the recruitment of volunteer Next Generation Science Standards liaisons in each district. These educators facilitated two-way communication between the Rhode Island State Leadership Team (RISLT) and educators in its districts. Liaisons shared information from the RISLT with educators in their school and conveyed educators' questions and concerns to the RISLT (Rhode Island Department of Education 2014).

Has the state identified mechanisms for seeking input and gathering feedback?

Feedback loops help to promote stakeholder engagement in implementing new standards. Providing stakeholder groups with opportunities to review and initiate feedback at critical junctures in the process can surface concerns that might be growing within certain communities and provide in-time opportunities for addressing these concerns. SBEs can support state efforts to solicit feedback by helping identify currently available methods of soliciting feedback and suggesting additional low-cost methods:

- public commenting periods
- SBE meetings
- "road shows," in which education leaders travel to different parts of the state to provide information sessions, hear concerns, and gather feedback
- online surveys
- interviews and focus groups

The SBE can collaborate with the SEA, unions, and professional organizations to develop a plan for collecting feedback on implementation, including major milestones or critical junctures for soliciting necessary feedback. When developing this plan, it will be important to identify strategies for communicating back to stakeholder groups about concerns and feedback that have been received and how issues that were raised are being addressed. Indeed, telling people what you have heard and how you are responding is a key element of effective communications. For example, in State Spotlight: California (below), the SBE delayed adoption and then asked for additional support related to learning progression models based on feedback received during the preadoption phase.

State Spotlight: California

The Next Generation Science Standards adoption process in California highlights the importance of two-way, responsive communication. During preadoption, the state received numerous public comments and heard presentations from the state's Science Expert Panel (SEP) and the California Department of Education. To give teachers more time to review the standards, California delayed adoption; in September 2013, the California State Board of Education adopted the standards (The Hunt Institute 2014).

After receiving additional feedback from teachers and administrators, the SBE took further action. In November 2013, the SBE approved the SEP's recommended integrated learning progression model as its preferred model. Implementing this model required significant reconfiguration because previous standards focused on one science discipline per year. After hearing concerns about the availability of curriculum materials and professional learning, the SBE approved the state superintendent of public instruction's recommendation that SEP reconvene to develop an alternative, discipline-specific model (California Department of Education 2014).

Additional Resources

Chapter 6: Develop a Stakeholder Engagement Strategy—This part of the larger *Next Generation Science Standards Adoption and Implementation Workbook* (Achieve 2013) walks participants through developing three key messages, identifying stakeholders, building a guiding coalition, and developing a stakeholder outreach strategy.

Engaging Business in Support of Next Generation Science Standards—This 2014 slide presentation by Jason Weedon walks through eight steps for engaging business representatives in the adoption and implementation of Next Generation Science Standards and includes examples of what other states have done.

Effective Communications for NGSS Adoption and Implementation Efforts—This slide presentation from the 2014 Next Generation Science Standards Annual Leadership Meeting shares communications plan guidelines and identifies potential next steps.

Communications Toolkit for California—As part of its communication efforts regarding the Common Core State Standards, the California Department of Education created a toolkit intended to make messaging more consistent across districts while providing districts the flexibility to modify the resources to reflect local contexts. The toolkit includes key messages and talking points, tips for messaging, links to resources on the state website, and communications outreach tips. States may want to consider creating similar toolkits for their new science standards.

Organize to Implement: Getting the Message Out—Part of a larger implementation workbook, this resource from Achieve and the U.S. Education Delivery Institute contains guidance, case studies, examples, and worksheets to help states establish guiding coalitions and create communications plans. Although intended to support Common Core State Standards communication efforts, this resource may also be used to inform communications efforts related to new science standards.

From "Inform" to "Inspire": A Framework for Communications and Engagement—The Reform Support Network developed this framework to support Race to the Top grantees in making far-reaching reforms and communicating about them. The framework encourages the development of feedback loops between the SEA and stakeholders in the policy reform process.

Supports for District Implementation

Do districts have the curricular, infrastructure, and professional learning supports needed to implement the new standards?

Potential upfront implementation costs for districts may include the purchase or development of new or revised instructional materials aligned to new standards. Districts may also need to fund professional development to help teachers and school leaders transition to new standards, the development or purchase of new assessments, and updates to technological infrastructure to support the use of new instructional delivery methods (e.g., education technology) or to administer new assessments. Recurring costs may include maintaining and revising assessments, updating technology, updating instructional materials, and providing ongoing professional development (National Conference for State Legislatures 2014).

Professional learning is critical. Districts will need to provide instructional leaders with professional development relative to establishing school conditions that will support standards implementation and student achievement (National Research Council 2012). In addition, districts will need to provide high-quality, job-embedded opportunities for teachers to review the standards, understand the instructional shifts they demand, and plan instruction aligned to the standards. When planning professional learning opportunities for teachers, states and districts should make sure that professional learning does the following:

- provide a coherent, focused, and sustained set of supports (National Research Council 2011);
- address the conceptual shifts of new standards (Pellegrino, Wilson, Joenig, and Beatty 2014);
- deepen understanding of science pedagogical content knowledge (National Research Council 2012);
- address the instructional implications of new standards (Pellegrino et al. 2014);
- help teachers incorporate disciplinary core ideas, science engineering practices, and crosscutting concepts into single lessons (National Research Council 2012);
- involve active sense making and problem solving (Reiser 2013);
- provide opportunities for teachers to work together to apply what they learn to their own classrooms (Reiser 2013);
- build teachers' capacity to use multiple strategies, including discussions and student models, to inform formative assessment (National Research Council 2012); and
- address design and implications of assessment tasks (Pellegrino et al. 2014).

Key Resource from NASBE

States Working Together on Professional Development for Implementing the New Science Standards [Webinar]. Washington: NASBE. http://www.nasbe.org/wp-content/uploads/NASBE-NGSS-Professional-Development-Webinar.pptx

The SBE can play a role by requesting that the SEA or its leadership team identify the conditions needed to implement the new standards. The SBE may also request that the SEA assess district readiness to implement the new standards with the following considerations in mind:

- To what extent do districts have the required infrastructure (e.g., classrooms and laboratory space, laboratory equipment) needed to implement the new standards?
- To what extent are current district curricular materials aligned with the new standards? What is needed to align the materials (e.g., provide teachers time to supplement or revise current materials)?
- To what extent are alternative standards or anchors aligned with the new standards?
- To what extent has the SEA (or district) identified the instructional strategies needed to support special education students, English language learners, and other specific student subgroups in meeting the standards?
- To what extent do districts have the resources (e.g., time, funding, expertise) to provide professional learning experiences that are reflective of the best practices outlined above?

> "State boards of education hold authority for student success and are positioned to leverage professional learning as a strategy for improving results for educators and students, while guiding the state department of education, local school board systems, third-party providers, institutions of higher education, and others toward successful implementation." (Killion and Hirsch 2012, 37–38).

SBEs can further support SEAs by helping to review the results of district needs assessments, identify gaps in readiness and the range of capacity across schools and districts based on the results, and work in concert with the leadership team to identify mitigation strategies. Some questions to consider in developing mitigation strategies include the following:

- Must state funding increase before new standards can be adopted?
- What are the current policies and requirements related to science classroom facilities? Do these need to be revised?
- Can the SEA fill existing gaps in readiness and capacity at the district level? Can the SEA support districts with the transition by providing professional learning, releasing lists of vetted materials or books aligned to the new standards, or defining criteria for determining alignment between the new standards and curricular materials?
- How can districts and the SEA partner with local universities, regional education centers, and federal technical assistance centers to support district implementation of new standards?
- Are there lessons to be learned from the work of other states relative to how districts can successfully transition to new science standards? Which states could serve as appropriate models or as potential sources of information?

State Spotlight: Connecticut

In Connecticut, results of a multiphased adoption implications study have helped inform implementation plans. These activities will culminate in recommendations to the SBE and include the following:

- developing a content crosswalk
- administering a district implications survey
- preparing an instructional shifts report
- convening middle/high school course-mapping study groups

State Spotlight: Massachusetts

New science standards are likely to call for improved opportunities for hands-on learning experiences in laboratory environments. In 2004, the Massachusetts state legislature created the Massachusetts School Building Authority (MSBA) to replace a former school building assistance program housed under the Massachusetts Department of Elementary and Secondary Education. The MSBA has a dedicated revenue stream drawn from the state's 6.25 percent sales tax. MSBA reimburses cities, towns, and regional school districts for school construction projects. In 2011, a task force composed of MSBA board members and staff, Massachusetts Department of Elementary and Secondary Education staff, science educators, science and technology consultants, science laboratory safety consultants, local architects, and construction management consultants designed new guidelines for science laboratories in high schools as well as prototypical plans. Since then, MSBA has launched a $60 million competitive grant program to which districts can apply for funds to update their science laboratories. To date, high schools in eight districts have received funding for the redesign of science laboratories to ensure that their students will have access to science laboratories that will support learning of 21st century science curricula.

Do state policies encourage high-quality professional learning opportunities for teachers and leaders?

To promote teacher access to high-quality professional learning, the SBE can request SEA review of state professional learning standards and policies. In the context of standards implementation, it will be important to ensure that the state's professional learning standards are current and that policies support high-quality professional learning. Archibald et al. (2011) highlight some important considerations:

- Do professional learning standards emphasize the importance of sustained, job-embedded activities that model good pedagogical practices and align with school, district, or educator goals and priorities? If not, what changes in standards are needed?
- Are state professional learning standards aligned with professional teaching standards? If not, what policy changes are needed?
- Are state-funded professional learning opportunities assessed in terms of their alignment to standards, impact on pedagogical practice, and impact on student outcomes? If not, are policy changes needed?
- Does the SEA's state data system currently track the types and amount of professional learning in which teachers participate? If not, are policy changes needed?
- Does the state data system provide timely access to student achievement and teacher performance data to help inform professional learning plans? If not, are policy changes needed?

- Does the state fund professional development time? If not, what legislative or regulatory changes are needed?
- Do SEA staff members provide technical assistance to districts on how to find time for professional learning and how to evaluate the quality and outcomes of professional learning?
- Has the state disseminated information about how professional learning in science should look?

State Spotlight: Washington

In its 2014 report, the Washington SBE noted that school districts rely on basic education waiver requests related to the 180-day and instructional hour requirements to implement professional learning. The SBE also noted discrepancies between the 180-day and instructional hour requirements in which some activities, such as parent-teacher conferences, may count toward instructional hour requirements but not toward day requirements. In addition, many districts use half days in order to provide professional development and still meet 180-day requirements. The SBE recognized the importance of providing teachers with adequate time to engage in professional learning but also wanted to ensure that students have sufficient instructional time to meet the rigors of new standards and graduation requirements. In its report to the governor, legislative education committees, and the state superintendent, the SBE advocated for the reinstatement of state-funded professional development time for teachers. This call for funding was echoed by the Professional Educator Standards Board in the same report. Providing a statewide program of effective professional learning is an SBE legislative priority for the 2015 legislative session.

Key Resources From the GTL Center

Job-Embedded Professional Development: What It Is, Who Is Responsible, and How to Get It Done Well (Croft et al. 2010) describes research on job-embedded professional development, provides descriptive examples, and details the conditions necessary for successful implementation. It also provides recommendations for how states, districts, and schools can support high-quality, job-embedded professional development to advance teaching and learning in all schools.

High-Quality Professional Development for All Teachers: Effectively Allocating Resources (Archibald et al. 2011) includes a summary of current research and policy related to high-quality professional learning, a discussion of factors to consider when setting policy and allocating resources, a description of how to evaluate professional learning, examples of promising approaches, and self-assessment tools that states can use to determine if they are on track for preparing high-quality professional learning.

Additional Resources

Indiana STEM Implementation Rubric—The Indiana Department of Education created this rubric to help schools determine their level of implementation and develop an understanding of critical implementation components. An SBE may want to refer to this document when considering the supports districts may need in order to implement new standards or consider asking the SEA to create a similar tool for districts to assess their readiness to implement standards.

Standards for Professional Learning: Quick Reference Guide—This document provides an overview of Learning Forward's standards for professional learning, identifies prerequisites for effective professional learning, and gives suggestions for using professional learning standards.

Assessment

Does the state have a plan for determining whether to revise current state assessments, acquire state assessments already in use elsewhere, or develop new ones?

Assessment results, when aligned with science standards, can inform teacher adjustments in practice and can help states identify additional supports and policy changes needed to promote student success in science. SBEs can play a critical role in guiding the conversation related to public policy and student performance. Darling-Hammond (2013) identifies three challenges that SBEs and experts face related to effective assessment:

- creating high-quality assessments that evaluate 21st century skills rather than low levels of knowledge
- "investing wisely in assessment systems that can actually help improve teaching and learning" (p. 22)
- ensuring that assessments are used to support—rather than to punish—students, teachers, and schools

Rather than focus solely on end-of-course statewide assessments for science, the National Research Council (Pellegrino et al. 2014) emphasizes the need for a system of assessments that includes the following:

- assessments to support classroom instruction, including both formative and summative tasks
- assessments to monitor science learning on a district or state level
- "a series of indicators to monitor that the students are provided with adequate opportunity to learn science in the ways laid out in the framework and the [new science standards]" (Pellegrino et al. 2014, p. 4)

With these considerations for assessment in mind, the SBE can promote strong policy and practice by requesting that the SEA or a review committee determine the alignment between current state and local assessments and the new standards. In addition, SBEs can reach out to SBE members in other states to learn about their assessment practices and whether any of the assessments used in their states and districts may be good fits or potential models. Although assessing the extent to which there is alignment between existing assessments and new state standards and whether assessments used in other jurisdictions may be more closely aligned is not a straightforward process, assessments that experts have identified as aligned with strong science standards do the following:

Key Resource from the National Research Council

Developing Assessments for the Next Generation Science Standards is available as a free resource. This book shares an approach to science assessment as well as strategies for developing assessments.

- require students to demonstrate their understanding of practices, core ideas, and crosscutting concepts (Pellegrino et al. 2014);

- include multicomponent tasks with a variety of response formats (Pellegrino 2014);
- examine higher-order thinking and require students to relate their knowledge to new contexts (Darling-Hammond 2013; Darling-Hammond et al. 2013). Assessments should provide "insights into how students think as well as what they know" (Darling-Hammond et al. 2013, 3);
- require students to apply critical science skills in the standards in authentic applications (Darling-Hammond et al. 2013);
- include assessment items or tasks focused on concepts that can be taught or learned rather than those that reflect differential access to out-of-school learning experiences or test-taking skills (Darling-Hammond et al. 2013); and
- are valid, reliable, fair, and accessible to all learners (Darling-Hammond 2013; Darling-Hammond et al. 2013).

Key Resource From NASBE

In July 2014, NASBE offered a webinar on designing and aligning assessments to Next Generation Science Standards.

A thorough review of the alignment between standards and assessments will likely have implications for state policies and practices. Analyze the results of the review and consider what policies may need adjustment in order to support implementation of new science standards:

- How, if at all, does the transition plan require adjustment given the availability or lack of high-quality, standards-aligned assessments?
- What resources will districts need to align current assessments or develop new assessments that align to the science standards?
- Are there formative, benchmark, and summative assessments that the SEA can share as models?
- Will joining an assessment consortium reduce assessment costs or pose challenges?
- Will the state adopt, adapt, or create standards-aligned science assessments to be included in the state accountability system?

Did You Know?

Many states and their SBEs may be concerned about the cost of developing new, high-quality assessments, but there are ways to reduce costs. Although per-pupil costs can be nearly triple that of implementing traditional multiple-choice assessments, Topol, Olson, and Roeber (2010) found that states can reduce costs by employing one or more of the following strategies:

- joining consortia and thus establishing economies of scale
- moving to online delivery to reduce production and shipment costs
- paying teachers stipends to score performance tasks or using professional development time to score assessments
- using distributive scoring or a mixture of computer and human scoring for written response tasks

Another potential cost-saving measure involves reducing the frequency with which assessments are monitored (Pellegrino 2014).

Does the state have a clear timeline for including science in the state accountability system?

Once an approach to assessment has been identified (revising, adapting, or adopting), SBEs can support the standards implementation process by reviewing the leadership committee's proposed implementation timeline for rolling out the assessments, working with the SEA to determine whether the timeline is still feasible and to make adjustments as needed. Experts recommend gradual and prioritized implementation of assessments (Pellegrino 2014). A gradual and prioritized approach to implementation may include several steps prior to full statewide implementation. Key questions for SBEs to consider with their SEA leaders include the following: When will assessments be pilot tested? When will full implementation occur? When would it be feasible to include science in accountability systems?

Pellegrino et al. (2014) recommend focusing first on assessments that can inform classroom-level instruction and assessment and then moving toward larger-scale assessments. In addition, using various forms of assessment not limited to standardized tests will help capture the extent to which students are demonstrating key science competencies. New teacher performance assessments, such as the edTPA tool from Stanford and the TeachingWorks National Observational Teaching Examination, may also be able to capture information about teachers' knowledge.

Spotlight: District of Columbia

In its ESEA Flexibility Waiver Request, the District of Columbia Office of the State Superintendent (OSSE) laid out an accountability plan that would include science assessments in the accountability system in July 2014. However, adoption of the Next Generation Science Standards by the SBE in 2013 has since prompted further discussion and action related to the inclusion of science in the district's accountability system. OSSE submitted an amendment request to the US Department of Education asking to postpone the inclusion of science scores in school classifications to allow for the development of new assessments aligned to the CCSS and the collection of baseline data. The US Department of Education approved the amendment contingent upon the SBE's approval of the change. In August 2014, the state superintendent presented on the waiver extension request to the SBE. In September, the US Department of Education approved the adjusted timeline proposed by OSSE, which will postpone inclusion of science assessments in the accountability system until after Next Generation Science Standards–aligned assessments have been developed and administered in the 2016–17 school year.

Additional Resources

Performance Assessments: How State Policy Can Advance Assessments for 21st Century Learning—This report by Ace Parsi and Linda Darling-Hammond is intended to familiarize SBEs with performance assessments and help SBE members and other policymakers address issues around these assessments. The report also includes discussion questions states can use to analyze barriers and opportunities toward effective implementation of these assessments.

Classroom Assessment Tasks—Teams of science, mathematics, and engineering education professionals developed these sample middle school and high school assessment tasks that are aligned to the Next Generation Science Standards and the Common Core State Standards for Mathematics. More details about the development of these tasks can be found here.

A New Vision for Accountability—This article by Linda Darling-Hammond appeared in the September 2013 edition of the *American School Board Journal.* Although the article views assessments through the lens of the Common Core State Standards, the discussion is relevant to the implementation of new science standards.

Formative Assessments for Next Generation Science Standards: A Proposed Model—This paper by Joan Herman summarizes literature on effective formative assessment, proposes a model for assessment, and then highlights considerations for applying the assessment model to new science standards.

The Cost of New Higher Quality Assessments: A Comprehensive Analysis of the Potential Costs for Future State Assessments—This analysis aims to identify the amount of money a state will need to implement a high-quality assessment system.

Getting to Higher-Quality Assessments: Evaluating Costs, Benefits, and Investment Strategies—This report draws on analyses to estimate how much is being spent on assessments and how much higher quality assessments might cost.

College and Career Readiness

Do the new science standards align with the rigorous expectations of other college- and career-ready standards?

The standards used to set expectations for student performance across all subject areas should be coherent and comprehensive. Science courses often address both science standards and other college- and career-ready standards. Therefore, it is important that a state's new science standards do not stand in isolation but are consistent with the state's full set of college- and career-ready standards. One way that an SBE can help ensure the coherence of standards across subject areas is by requesting that the SEA conduct an alignment study between new science standards and other college- and career-ready standards as defined by national experts. A review of the results of this type of alignment study can lead to important policy and implementation recommendations and be guided by the following questions:

- Are additional changes to the standards needed to reflect the rigor of other standards?
- Where are areas of overlap in the standards?
    - How can the SEA and districts draw upon these areas of overlap in professional learning opportunities and cross-disciplinary learning connections for students?
    - How can the SEA and districts draw upon these areas of overlap in emphasizing critical content and skills in course offerings, curriculum, and other learning opportunities?
    - How can the SEA and districts draw upon these areas of overlap in emphasizing employability skills, career exploration, and real-world learning opportunities?

Will course sequences, including career and technical education (CTE) pathway requirements, dual enrollment requirements, and graduation requirements need to be revised to align with the new standards?

The National Research Council and the Next Generation Science Standards do not provide sample graduation requirements. SBEs adopting the Next Generation Science Standards should evaluate key differences between the Next Generation Science Standards and most current state science standards when considering changes to college- and career-ready policies (Eberle (2014b). New science standards may incorporate unique elements:

- inclusion of earth and space sciences
- integration of the disciplines and practices of sciences and crosscutting concepts in science
- explicit inclusion of English language arts skills as a performance expectation

Key Resource from NASBE

In a June 2014 *Policy Update*, Francis Eberle (2014b) discusses three critical steps in reviewing graduation requirements. This concise two-page document is an easy read and a useful reference.

As such, SBEs may consider requesting that the SEA review college- and career-ready policies, including instructional time requirements, graduation requirements, dual enrollment policies, CTE program requirements, and model course sequences. This review should include the identification of gaps between current policies and the expectations of the new standards. Based on research conducted by Eberle (2014b) and the National Research Council (2013), among others, important questions to consider in this review include the following:

- Do current graduation requirements reflect the expectations of the new science standards? If not, what policy changes are needed, and how should they be gradually implemented?
- Do current CTE requirements reflect the expectations of the new science standards? If not, what policy changes are needed, and how should they be gradually implemented?
- Are changes needed in GED program requirements in order to align them with the expectations of the new science standards?
- How do the state's graduation requirements compare with those of other states?

- How do the state's graduation requirements and the new science standards reflect the needs of local business and industry employment opportunities?
- Do state and national data (i.e., SAT and ACT data, Programme for International Student Assessment [PISA] results, NAEP results, CTE certification rates, college enrollment and persistence rates, percentage of students taking remedial science courses in college) suggest that revisions to graduation requirements are needed to ensure students are college- and career-ready in the sciences?
- Does the state gather data on the number of instructional minutes in science as well as the science-related opportunities that schools provide outside of the regular instructional day? Are these data available in other data sources (e.g., SASS teacher questionnaire, NAEP surveys, NCES High School Longitudinal Study)?

State Spotlight: Arkansas

Shortly after endorsing the Next Generation Science Standards, the Arkansas Department of Education released the state's *Review of the Next Generation Science Standards.* This document contains an analysis of potential implications of the new standards on college and career readiness policies. For example, the authors note that the state may need to amend current accreditation standards to require additional time for science instruction in grades K–8, to redefine natural science, and to redefine science in grades 6–12 resulting from the instructional shifts of the Next Generation Science Standards. In addition, the authors mention that the state will need to redefine the graduation requirement of three units of science with laboratory experience. To do this, the state will convene a committee to "determine high school course titles and what Next Generation Science Standards will be bundled together to create three high school courses that Smart Core/Core students will be required to take" (Arkansas Department of Education 2014, 28–29).

Additional Resources

Necessary for Success: Building Mastery of World-Class Skills (Patrick and Sturgis, n.d.) is a policymaker's guide to competency education. This guide, a smaller version of a larger report, provides policymakers with information on how they can set the vision for competency-based education, align the policy infrastructure, and create a culture of competency in SEAs. Although this report is not specific to science, the suggestions it contains can be applied to all subjects.

Next Generation Science Standards Appendix C: College and Career Readiness describes how the Next Generation Science Standards support students' college and career readiness and can help address the need for a workforce skilled in science and technology.

Next Generation Science Standards Appendix D: Case Studies is a resource with seven specific case studies, each focused on strategies classroom teachers can use to make the Next Generation Science Standards accessible for different groups of students.

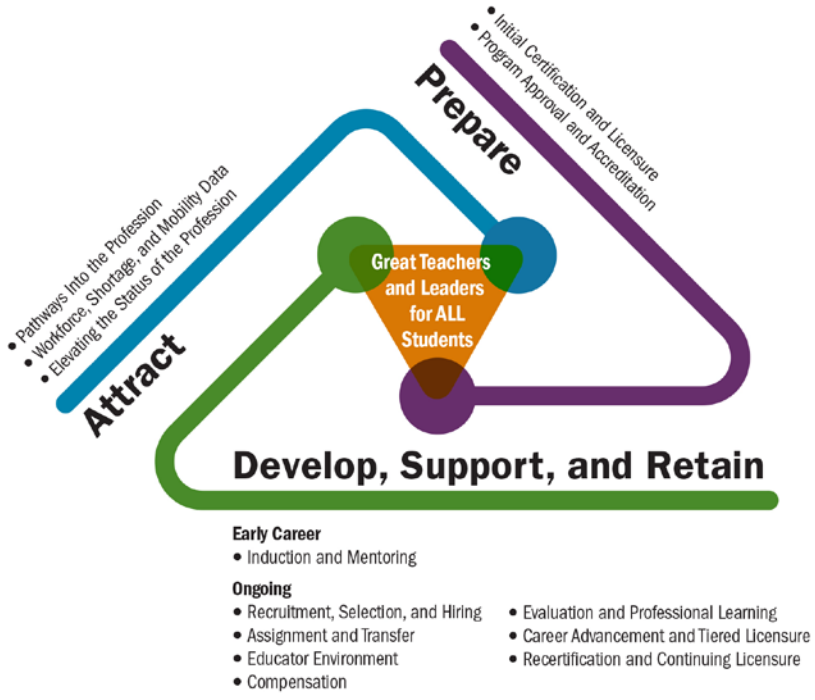
Talent Development (Educator Effectiveness)

Are policies aimed at recruiting, developing, and retaining effective science educators aligned with the instructional demands of the new science standards?

Talent development practices and the implementation of new standards, when implemented in a coordinated way, can strengthen the connections among standards and help determine what those standards look like in practice and how we can prepare and support teachers so they are ready to implement the standards. However, if these concurrent priorities are not addressed in a coherent manner, they can seem disconnected from one another and can confuse, frustrate, and overwhelm educators and instructional leaders (Leo and Coggshall 2013). Although it is not necessary to change talent development policies immediately, SBEs can be proactive by identifying policy changes needed to ensure coherence among the instructional expectations associated with the new science standards and various talent development practices.

The GTL Center's Talent Development Framework can help SBEs and SEAs move past piecemeal policies to create a coherent and aligned system to develop and support excellent teachers and leaders. Figure 2 identifies the various components of educator effectiveness included in the GTL Center's Framework. This resource describes how states can create coherent policies to prepare, attract, develop, support, and retain excellent educators. The GTL Center offers a range of technical assistance services to support states in using the framework.

Figure 2. Talent Development Framework



The first step in building policy coherence is to review the requirements for beginning teachers. Engage teacher preparation programs and resources, including alternative preparation program providers, science content experts, and districts in a review of current initial certification and licensure requirements and current program approval and accreditation requirements. In many states, the state board of higher education may spearhead this work by forming a committee that includes members drawn from these groups. This committee could be charged with answering questions and developing accompanying recommendations that address the following:

- What competencies will teachers need to effectively teach in light of the new standards? Are there specific competencies that are critical for instruction at different levels or in different disciplines?
- Do current certification requirements reflect these competencies?
- What assessments or artifacts will be used to assess candidates' readiness to enter the classroom?

Review the committee's recommendations, seek public input when appropriate, and then revise or adopt new policies as needed. Set a timeline for reviewing implementation data to determine whether changes are being implemented with fidelity and are resulting in strong teacher preparation. Plan to make adjustments as needed.

It is also important to understand how policies help or hinder experienced teachers in their readiness to effectively teach and implement the new standards. Request a review of the state and district policies categories listed in Figure 2. If it is not feasible to review district policies, it may be possible to review the data districts report to the state to better understand how effective these policies are. Consider and ask the following questions:

- Is the state compiling sufficient recruitment, selection, hiring, and retention data to know which teacher preparation programs are recruiting more highly qualified candidates to be science teachers and preparing teachers for the rigors of the classroom?
- How do state-provided or state-funded induction and mentoring program requirements need to be revised to support new teachers with the new standards? What recommendations should be provided to districts on how they can improve their programs?
- Do the expectations of current instructional frameworks reflect the teaching and leadership behaviors needed to implement the new science standards? What changes in policy or teaching practices might be necessary?

How will the new science standards affect the availability of student growth data to be used in educator evaluation data? For example, will there be a gap in the availability of high-quality assessment data aligned to the new standards? Is a stopgap measure needed? What policy changes are necessary?

What data are avaliable to assess the effectiveness of teacher preparation programs in developing effective science teachers?

Many states have developed or are beginning to develop public "report cards" for teacher preparation programs. These documents often share outcomes from teacher certification

examinations, graduate placement in teaching positions, teacher evaluations, and student outcomes. SBEs in states with such documents can seek information on how the SEA or state board of higher education may need to adjust these report cards following adoption of new standards and preparation requirements.

State Spotlight: Arkansas

Shortly after endorsing the Next Generation Science Standards, the Arkansas Department of Education released the state's *Review of the Next Generation Science Standards* (Arkansas Department of Education 2014). This document contains an analysis of potential implications of the new standards on educator effectiveness policies. The report notes that professional development opportunities must address the following:

- "the integration of science and engineering practices and crosscutting concepts with science content for several years
- engineering practices and the engineering design cycle for several years
- the use of formative assessments in science classrooms
- the use of models and constructing models from evidence" (Arkansas Department of Education 2014, 25)

In addition, the report emphasized the need to do the following:

- align Next Generation Science Standards with *A Framework for Teaching*
- address middle school teacher preparation requirements to increase discipline-specific content knowledge
- develop new licensure competencies for grades 7–12 because earth and space science content will be added to the curriculum

Key Resources from the GTL Center

Policy Snapshots. The GTL Center offers policy snapshots that provide an overview of the latest information, research, and policy trends on critical education policy topics in a quick, easy format. *Supporting New Teachers: What Do We Know About Effective State Induction Policies?* summarizes research on effective induction programs and offers strategies for setting effective policy related to induction plans. The brief includes spotlights on state induction programs as well as sample regulatory language. In *Alternative Routes to Teaching: What Do We Know About Effective Policies?*, expert Laura Goe discusses research on the extent to which alternative routes into teaching meet state goals and shares six policy strategies to consider as priority actions for creating or improving statewide requirements for alternative routes to certification.

Equitable Access Toolkit. This toolkit is designed to support states' efforts to ensure equitable access to excellent educators. The toolkit includes resources and materials focused on stakeholder engagement, root-cause analysis, and data review to develop plans to improve access to high-quality, effective educators. Although not focused on science educators, the tools here can be used to determine the policy changes and strategies needed to ensure talent development practices are effective and to recruit, develop, support, and retain highly effective science educators.

References

Achieve. 2013. *Next Generation Science Standards adoption and implementation workbook.* Washington, DC. Retrieved from http://www.achieve.org/publications/ngss-adoption-and-implementation-workbook

Achieve. 2012. *Implementing Common Core State Standards and Assessments: A workbook for state and district leaders.* Washington, DC. Retrieved from http://www.achieve.org/files/Common_Core_Workbook.pdf

Archibald, S., Coggshall, J. G., Croft, A., and Goe, L. 2011. *High-quality professional development for all teachers: Effectively allocating resources.* Retrieved from http://www.gtlcenter.org/sites/default/files/docs/HighQualityProfessionalDevelopment.pdf

Arkansas Department of Education. 2014. *Review of the Next Generation Science Standards: A summary of the work by Arkansas educators through April 2014.* Retrieved from http://www.arkansased.org/public/userfiles/Learning_Services/Curriculum%20and%20Instruction/Science_Standards/Review_of_the_Next_Generation_Science_Standards.pdf

Board on Science Education, Division of Behavioral and Social Sciences and Education, National Research Council of the National Academies. 2015. *Guide to implementing the Next Generation Science Standards: Committee on Guidance on Implementing the Next Generation Science Standards.* Washington, DC: The National Academies Press. Retrieved from http://www.nap.edu/catalog/18802/guide-to-implementing-the-next-generation-science-standards

California Department of Education. N.d. *NGSS for California public schools, K–12*. Retrieved from http://www.cde.ca.gov/pd/ca/sc/ngssstandards.asp

California Department of Education. 2012. *Communications toolkit for California.* Retrieved from www.cde.ca.gov/re/cc/documents/cdecommstoolkit.doc

California Department of Education. 2014. "Next Generation Science Standards," http://www.cde.ca.gov/pd/ca/sc/ngssintrod.asp.

Charbonneau, J. 2013. "Time to start teaching new science standards for the next generation." *The Seattle Times* (October 6). Retrieved from http://seattletimes.com/html/opinion/2021968443_jeffcharbonneauopednextgen07xml.html

Colby, C., and Stenos, M. 2014. "Integrating communications into implementation plans." Presentation given at the NGSS Leadership Conference, Atlanta, GA. Retrieved from http://www.nextgenscience.org/sites/ngss/files/Integrating%20Communications%20into%20Implementation%20021814.pptx

Connecticut State Department of Education. N.d. *Next Generation Science Standards (NGSS): Connecticut's adoption implications study.* Retrieved from http://www.sde.ct.gov/sde/lib/sde/pdf/curriculum/science/ct_state_ngss_adoption_implications_study.pdf

Croft, A., Coggshall, J. G., Dolan, M., Powers, E., and Killion, J. 2010. *Job-embedded professional development: What it is, who is responsible, and how to get it done well.* Retrieved from http://www.gtlcenter.org/sites/default/files/docs/JEPD%20Issue%20Brief.pdf

Darling-Hammond, L. 2013. "A new vision for accountability." *American School Board Journal.* Retrieved from https://edpolicy.stanford.edu/sites/default/files/publications/student-assessments-work.pdf

Darling-Hammond, L., Herman, J., Pellegrino, J., Abedi, J., Aber, J. L., Baker, E., et al. 2013. "Criteria for high-quality assessments" (Policy Brief: SCOPE, CRESST, LSRI). Retrieved from https://edpolicy.stanford.edu/sites/default/files/publications/criteria-higher-quality-assessment_1.pdf

Delaware State Board of Education. N.d. *Delaware State Board of Education strategic plan 2011–2015.* Retrieved from https://eboard.eboardsolutions.com/Meetings/Attachment.aspx?S=190001&AID=7183&MID=335

Dorn, R. 2014. "Why my state adopted the Next Generation Science Standards." *Commentaries* 20, no. 1 (March). Alexandria, VA: National Association of State Boards of Education. Retrieved from http://www.nasbe.org/wp-content/uploads/Commentary-Randy-Dorn-NGSS-WA-Final.pdf

Eberle, F. 2014a. "A goal without a plan is just a wish: The Maryland State Board of Education's Path after the Adoption of the Next Generation Science Standards." *State Innovations* 19, no. 1 (March). Alexandria, VA: National Association of State Boards of Education. Retrieved from http://www.nasbe.org/wp-content/uploads/Maryland-NGSS-State-Innovations-Final.pdf

Eberle, F. 2014b. Graduation requirements and the Next Generation Science Standards. *Policy Update* 21, no. 2 (June). Alexandria, VA: National Association of State Boards of Education. Retrieved from http://www.nasbe.org/wp-content/uploads/PU_NGSS-and-Grad-Requirements_6-14-2.pdf

Herman, J. 2013. *Formative assessments for Next Generation Science Standards: A proposed model.* Princeton, NJ: ETS. Retrieved from http://www.k12center.org/rsc/pdf/herman.pdf

The Hunt Institute. 2014. *Moving forward: State engagement with the Next Generation Science Standards.* Durham, NC. Retrieved from http://www.hunt-institute.org/elements/media/files/reVISION-No5-Case-Study-web.pdf

Indiana Department of Education. N.d. *Indiana's Department of Education STEM education implementation rubric*. Retrieved from http://www.doe.in.gov/sites/default/files/ccr/stem-implementation-rubricv3.pdf

Killion, J., and Hirsch, S. 2012. "Role of state boards of education in professional learning for implementing college- and career-ready standards." *The State Education Standard* (August): 37–42. Retrieved from http://www.nasbe.org/wp-content/uploads/The-Role-of-State-Boards-of-Education-in-Professional-Learning.pdf

Learning Forward. N.d. *Standards for professional learning: Quick reference guide*. Retrieved from http://learningforward.org/docs/pdf/standardsreferenceguide.pdf?sfvrsn=0

Leo, S. F., and Coggshall, J. 2013. *Creating coherence: Common Core State Standards, teacher evaluation, and professional learning.* Washington, DC: Center on Great Teachers and Leaders. Retrieved from http://www.gtlcenter.org/sites/default/files/CreatingCoherence.pdf

National Association of State Boards of Education. 2015. *NGSS–Communication workbook*. Retrieved from http://www.nasbe.org/our-resources/interactive-classroom/ngss-communication/

National Conference for State Legislatures. 2014. *Costs associated with the Common Core State Standards*. Retrieved from http://www.ncsl.org/research/education/common-core-state-standards-costs.aspx

National Research Council (NRC). 2012. *A framework for K–12 science education: practices, crosscutting concepts, and core ideas.* Washington, DC: National Research Council of the National Academies. Retrieved from http://www.nap.edu/openbook.php?record_id=13165

Next Generation Science Standards. 2014. *Planning for success: Effective communications for NGSS adoption and implementation efforts*. Retrieved from http://www.nextgenscience.org/sites/ngss/files/NGSS%20Comms%20Strategies_Leadership%20Conf%20ATL_02_18_14.pptx

Parsi, A., and Darling-Hammond, L. 2015. *Performance assessments: How state policy can advance assessments for 21st century learning.* Alexandria, VA, and Stanford, CA: National Association of State Boards of Education and Stanford Center for Opportunity Policy in Education.

Patrick, S., and Sturgis, C. N.d. *Necessary for success: Building mastery of world-class skills—A state policymaker's guide to competency education* (executive summary). Vienna, VA: International Association for K–12 Online Learning. Retrieved from http://www.nmefoundation.org/getmedia/e5dd4df1-3535-473c-bfc8-567497893b34/inacol-cw-issuebrief-building-mastery-exec-summ-final?ext=.pdf

Pellegrino, J. W. 2014. "Developing assessments for the Next Generation Science Standards." Presentation given at the NGSS Leadership Conference, Atlanta, GA. Retrieved from http://www.nextgenscience.org/sites/ngss/files/NRC%20Science%20Assessment%20Report.NGSS_.Atlanta-Pellegrino.ppt

Pellegrino, J. W., Wilson, M. R., Joenig, J. A., and Beatty, A. S., eds. 2014. *Developing assessments for the Next Generation Science Standards*. Washington, DC: National Research Council of the National Academies. Retrieved from http://www.nap.edu/openbook.php?record_id=18409

Reform Support Network. N.d. *From "inform" to "inspire": A framework for communications and engagement.* Washington, DC. Retrieved from http://www2.ed.gov/about/inits/ed/implementation-support-unit/tech-assist/framework-communications-engagement.pdf

Reform Support Network. 2013. *Measurable success, growing adoption, vast potential: Social media use among state and local education agencies.* Washington, DC. Retrieved from http://www2.ed.gov/about/inits/ed/implementation-support-unit/tech-assist/social-media-use.pdf

Reiser, B. J. 2013. "Professional development to support NGSS." Presented in "States working together on professional development for implementing Next Generation Science Standards," a webinar conducted by the National Association of State Boards of Education, Alexandria, VA. Retrieved from: http://www.nasbe.org/wp-content/uploads/NASBE-NGSS-Professional-Development-Webinar.pptx

Rhode Island Department of Education. 2014. *Next Generation Science Standards*. Retrieved from http://www.ride.ri.gov/InstructionAssessment/Science/NextGenerationScienceStandards.aspx

Topol, B., Olson, J., and Roeber, E. 2010. *The cost of new higher quality assessments: A comprehensive analysis of the potential costs for future state assessments*. Retrieved from http://www.edweek.org/media/costs_of_new_high_quality_assessments.pdf

Washington State Board of Education and Professional Educator Standards Board. 2014. *Washington State Board of Education and Professional Educator Standards Reform: Working together for student achievement* (Fifth biennial joint report). Retrieved from http://www.sbe.wa.gov/documents/SBE_PESB_ReportOct2014.pdf/

Washington State Office of Superintendent of Public Instruction. 2013. "Dorn adopts new science standards," Press release, October 4. Retrieved from http://www.k12.wa.us/Communications/PressReleases2013/NewScienceStandards.aspx

Weedon, J. 2014. "Engaging business in support of Next Generation Science Standards," Slide presentation. Retrieved from http://www.nextgenscience.org/sites/ngss/files/Engaging%20Business%20in%20Support%20of%20NGSS%20-%20Weedon.pptx

Yoo, P. 2012. "Common Core adoption and implementation: The state board—legislature connection interviews with state board chairs and legislatures in three states." *The State Education Standard* 13, no. 1 (September): 49–54. Retrieved from http://www.nasbe.org/wp-content/uploads/Common-Core-Adoption-and-Implementation-teh-State-Board-Legislature-Connection.pdf