NEXT GENERATION SCIENCE STANDARDS
For States, By States

NEXT GENERATION SCIENCE STANDARDS

Adoption and Implementation Workbook

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Introduction

The Challenge of Standards Adoption and Implementation

The Next Generation Science Standards (NGSS) represent the culmination of years of collaboration and effort by states, science educators and experts from across the United States. Based on the National Research Council's *A Framework for K-12 Science Education*[1] and developed in partnership with 26 lead states, the NGSS, when implemented with fidelity, have the potential to fundamentally alter the landscape of American science education and prepare students for college, careers and life in the 21st century.

This workbook is designed for state leaders who intend to adopt and implement the NGSS so that the standards bring about the change in classroom instruction and student achievement that they promise. If you are reading this workbook, you probably already recognize the potential of the NGSS to improve science education and achievement (and if you do not, the partnership developing the standards has already astutely articulated the case for them through the many resources at www.nextgenscience.org).

Adoption and implementation of the NGSS are no small tasks for several reasons. One reason is the content of the standards themselves: The NGSS require several shifts in the way that science is taught, which will be explored throughout this workbook. At the heart of these shifts is a fundamental change in how students will demonstrate proficiency.

The vision represented in the *Framework* is new in that it requires — for the first time — that students be engaged at the nexus of three dimensions: (1) Science and Engineering Practices, (2) Crosscutting Concepts and (3) Disciplinary Core Ideas. Given the importance of science and engineering in the 21st century, students require a sense of contextual understanding with regard to scientific knowledge, how it is acquired and applied, and how science is connected through a series of concepts that help further their understanding of the world. To that end, the standards have been written as performance expectations requiring that students demonstrate all three dimensions through contextual application of the three dimensions.

This change is illustrated in the side-by-side comparison of middle school science standards in Figure 1.

[1] National Research Council. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press, 2012.

FIGURE 1: Standards Comparison: Structure and Properties of Matter

Current State Middle School Science Standards	NGSS Middle School Sample Standards*
a. Distinguish between atoms and molecules. b. Describe the difference between pure substances (elements and compounds) and mixtures. c. Describe the movement of particles in solids, liquids, gases and plasma states. d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility). e. Distinguish between changes in matter as physical (i.e., physical change) or chemical (i.e., development of a gas, formation of precipitate, and change in color). f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements. g. Identify and demonstrate the Law of Conservation of Matter.	a. Develop molecular-level models of a variety of substances, comparing those with simple molecules to those with extended structures. b. Design a solution that solves a practical problem by using characteristic chemical and physical properties of pure substances. c. Construct an explanation about why change in temperature and/or change of state can occur when adding or removing thermal energy from a pure substance. d. Analyze and interpret the properties of products and reactants to determine if a chemical reaction has occurred. **Note that these are only samples and do not necessarily reflect the final standards.*

The difference in the verbs used in the NGSS tells the story. Gone is the conception of science education as an abstract recall of facts. Instead, students demonstrate proficiency in science by engaging in actual scientific practices — in this case, developing models, designing solutions and constructing arguments. In the words of one standards author, the NGSS require that students move from demonstrating good note-taking skills to demonstrating true understanding of scientific practices, concepts and core ideas. The resulting implications for classroom practice could not be greater.

This first challenge for NGSS adoption and implementation is multiplied by the second: the sheer scale at which the change must take place. Each state adopting and implementing the NGSS will need to equip and motivate hundreds or thousands of district leaders, principals and teachers to change their day-to-day practices. Moreover, this change comes in the context of existing and ongoing efforts in most states to implement the Common Core State Standards (CCSS) for English Language Arts/Literacy and Mathematics. Any NGSS implementation effort will need to be coherent with, and build upon, the work that is already under way.

One of the main objectives of this workbook is to help state leaders think through an NGSS adoption strategy and timeline. State science education advocates will need to make the case for these new standards and be prepared to answer questions from those charged with standards adoption in their states (usually state boards of education, but in some states adoption is the purview of general assemblies or chief state school officers). These questions are likely to include inquiries about the state's transition timeline and strategy for incorporating these standards into the full range of education

reforms unfolding in states. In many states that are implementing the CCSS, the role of the state education agency is changing from compliance/monitoring to supporting and responding to district and school needs. State boards of education, legislatures and chiefs will be more willing to adopt the NGSS if they are given a clear sense that state leaders — and the districts, schools and classrooms that the NGSS will ultimately affect the most — will be able to meet these challenges. Of course, states will also have flexibility to determine their own implementation timelines and structures. They can review their capacity and greatest needs in determining how to sequence and roll out the standards. Importantly, states can and should learn from each other and work together to meet common objectives.

How To Use This Workbook

All of this implies a need for state leaders to develop, manage and hold themselves accountable to a clear plan for NGSS adoption that anticipates the legitimate questions from policymakers and the need from the field to lay out a high-level strategy for implementation, including a timeline. This workbook should aid you in that process.

Taken as a whole, the elements in this workbook will allow your team to create a high-level implementation plan — an operational guide to your work — which will need to become much more detailed as standards implementation occurs over the next several years. At a minimum, this preliminary implementation plan will need to answer the questions that policymakers will most likely need to see addressed before they take action on adoption, and your plan will likely have multiple iterations. Given the current environment in state policymaking, an adoption plan will need to address key elements of your implementation plan: a clear case for change that is well communicated and is grounded in strategies that the state will employ and how the strategies will be implemented to improve student achievement.

Workbook Organization

The workbook is organized around elements of NGSS adoption and implementation that are critical to include in your state's plan; each chapter includes action steps to help guide your state's adoption and preliminary implementation of the NGSS:

Chapter 1: Designate a Strategic Leadership Team, Review Your Capacity for Adoption and Implementation, and Create a Timeline for Adoption and Preliminary Implementation

- Designate a strategic leadership team and understand its role;
- Complete a diagnostic assessment of your state's capacity to adopt and implement; and
- Establish an adoption and preliminary implementation timeline.

Chapter 2: Define Your Aspiration

- Develop a vision for how the NGSS will affect students and your state; and
- Understand what the NGSS will require.

Chapter 3: Evaluate Past and Present Performance

- Gather the relevant data;
- Distill key performance patterns and identify root causes; and
- Identify implications for adoption and implementation.

Chapter 4: Determine the State's Role and Approach to Implementation

- Define your state's role;
- Identify core implementation strategies; and
- Draw the delivery chain and identify feedback loops.

Chapter 5: Set Targets and Trajectories

- Establish a performance target;
- Connect your strategies to expected outcomes; and
- Create more detailed trajectories to monitor implementation progress.

Chapter 6: Develop a Stakeholder Engagement Strategy

- Develop key three messages;
- Identify and analyze the stakeholders who are most critical to successful adoption and implementation;
- Build your guiding coalition;
- Establish a process and plan to handle potential challenges; and
- Develop a stakeholder outreach strategy.

Chapter 7: Establish Routines and Solve Problems

- Reflect on existing performance management routines and consider how they can be adapted to monitor the progress of NGSS implementation; and
- Organize, prepare for and conduct routines.

Though you can read the workbook in a linear fashion from start to finish, some elements of the workbook will be more pertinent or pressing at certain times. Start with identifying the strategic leadership team and completing the diagnostic tool and self-assessment exercise in Chapter 1. Use the results to inform your reading and work on the areas of true need. Then set a timeline for adoption and preliminary implementation of the NGSS.

The remaining chapters of the workbook are organized around the above outline. Each of these chapters contains the following components:

Narrative, step-by-step guidance on how to develop the plan in your state. This guidance includes an introduction that defines the element, why it is important and what it comprises. After the introduction, each element is broken down into a series of action steps for state leaders to take.

Examples and references to NGSS content and practices. Where appropriate, the workbook illustrates the concepts in each of the elements and action steps with examples of how they might play out in a state. It also includes occasional references to the broader content and work around the standards. Many are drawn from the NGSS website (www.nextgenscience.org).

Exercises for state teams. Nearly every action step includes one or more exercises that will help your state team complete the step collaboratively. Exercises consist of discussion prompts, guiding questions and templates to fill out, as well as guidance for facilitators who are running the exercises. Taken as a whole, the exercises in this workbook should help your state team have the conversations necessary to develop and manage your adoption and implementation plans for the NGSS.

Finally, it is worth noting that states' roles in standards implementation continue to evolve. Capturing, distilling and sharing the lessons learned from your experiences will be important. Adoption and

implementation of the NGSS are critical to the goal of providing students with a well-rounded education experience that prepares them for college, careers and life.

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 consists of a discussion of the need for and role of your state's strategic leadership team in coordinating, driving and monitoring the adoption and implementation of the NGSS; a diagnostic tool for assessing your state's current capacity to adopt and implement the NGSS; and guidelines for setting a timeline for adoption and preliminary implementation of the NGSS.

Action Steps
Step 1: Designate a strategic leadership team and understand its role. **Step 2:** Complete a diagnostic assessment of your state's capacity to adopt and implement. **Step 3:** Establish an adoption and preliminary implementation timeline.

Step 1: Designate a Strategic Leadership Team and Understand Its Role

Ownership of the NGSS will sit in many different places across the state and even within the state education agency, which can pose a challenge for adoption and implementation. Thus, your state should put together a strategic leadership team tasked with creating an overall vision for the NGSS and a timeline, phase-in strategy and work plan for both adoption and implementation. The strategic leadership team ought to include a balance of leaders with the skills to drive implementation. Strategic leadership team members must be skilled at working with and coordinating a team. Thus, they will need strong problem-solving skills, interpersonal and relationship management skills, and "run room" from the senior leadership. The strategic leadership team should include representatives who are knowledgeable about your state's current science standards, have the capacity to consider and make recommendations about each of the elements that should be in the adoption and implementation plan, and ultimately can execute and oversee such a plan. The team must have knowledge of the state education agency's priorities and timing for action. The team also must be able to embed the NGSS work in and communicate with policymakers about how these elements of a broader agenda fit together and/or reinforce one another in a coherent way. In addition, the team needs to be cognizant of the political landscape and the levers of influence related to NGSS adoption.

The team should include representatives from the state department of education (curriculum and instruction, assessment, data, district support, special education, English language learners, etc.), higher education, the legislature, the governor's office and the business community. It is also critical that the team have deep expertise in relevant policies, budget and communications. The state may also want to include representation from leading districts and schools, including teachers, administrators and content area experts.

From the outset, identifying how the NGSS will be adopted in your state is critical and may influence your team's composition. Begin by considering the "who, what, when, why, where and how" questions. For example, *who* has the authority to adopt standards varies across states — from the state board of education to the legislature and, in some cases, the chief state school officer. States also differ with respect to *how* statutory requirements, public comment periods and hearings shape their standards adoption processes. (Preparation and documentation of *how* the state has been engaged in the standards development process may also be a helpful resource.)

Your strategic leadership team needs to grapple with a host of questions to create an adoption strategy, which you will explore in the remainder of this workbook. These questions include:

- What is the big-picture aspiration — or end goal — that grounds and focuses your NGSS efforts; allows for you to build the necessary coalition for adoption; and when challenges arise, allows for perseverance to implement the standards with fidelity? (See Chapter 2.)
- When do you anticipate the NGSS reaching the classroom? In all grades? Working backward, what are the elements that must be addressed in your plan and by when? Who has authority to make decisions in each of those areas? What expertise exists, and what capacity gaps remain? How will you know whether or not your state is on track? If full implementation takes years, how will you sustain your efforts over time? (See Chapters 1 and 4.)
- What supports will your state provide educators, and how do those needs inform the state's implementation timeline? What sort of professional development will be provided — and by whom? Will there be an effort to create curriculum frameworks and other instructional materials for classroom teachers? (See Chapter 4.)
- How will this work be funded? Have you had conversations with key legislators on appropriate committees to help them understand the purpose and timing of adopting the NGSS? Have you had internal budget discussions to identify various state and federal funding streams that can support this work? (See Chapter 4.)
- What impact will implementation of the NGSS have on the state's existing college- and career-ready policies and priorities? How can this effort move forward coherently to reinforce the state's goals for college and career readiness? (See Chapters 2 and 4.)
- Does your state have a coalition of supporters of the NGSS — including those both inside and outside the government — and how can you make certain that they are engaged around the adoption and implementation of the NGSS? (See Chapters 2 and 6.)

The strategic leadership team will help develop and monitor a strategy to engage stakeholders, provide briefing materials and timely updates to policymakers, and establish and monitor key feedback loops. (See Chapter 4.) Focusing on stakeholder engagement well before adoption of new standards is critical: Who needs to be engaged in the work? Who needs to be kept informed, and how you are going to interact with the various stakeholders? Informing and involving key state board of education members and legislators in discussions around adoption and implementation strategy is essential. Your state education agency public information officer and communications staff will need a plan and will need to reach out to a broader coalition of key stakeholders to build and maintain support for your efforts. These critical partners must be engaged from the beginning.

Adopting the standards in a state represents the beginning, not the end, of the process. The goal is for the content standards to actually affect teaching and learning in the classroom. As the implementation effort proceeds, your strategic leadership team will likely need to create other working teams to delve into specific issues, such as professional development design, and recommend how to proceed. Consider what mechanisms are in place to ensure fluid communication among the department of education, governor's office and other state education entities such as your higher education system or your teacher licensing board. Consider also what mechanisms can be used to provide project oversight to the agency's leadership team (e.g., the chief and key deputies).

EXERCISE 1: Designate Your Strategic Leadership Team

Objective(s) for participants:

- Identify the members of the strategic leadership team.
- Develop a strategy for engaging each member to support NGSS adoption and implementation.
- Identify the role(s) each member can play in creating an overall vision, timeline, adoption strategy and phase-in strategy for implementation. Discuss existing mechanisms that strategic leadership team members can use to execute, monitor and reinforce the state's efforts.

Instructions:

- Brainstorm possible members of the strategic leadership team, casting the widest net possible.
- Narrow the list by excluding those who would be unlikely to support the work.
- Evaluate the list using criteria such as diversity, balance, potential to work together, etc.

Materials needed:

- Flipchart paper
- Markers

Template for Exercise 1

Potential Member of the Strategic Leadership Team	Current Level of Engagement and Awareness of the NGSS (very low, low, high, very high)	Sphere of Influence (content knowledge, policy expertise, stakeholder engagement, etc.)	Specific Role	Next Steps

Step 2: Complete a Diagnostic Assessment of Your State's Capacity To Adopt and Implement

The diagnostic tool includes a category for each of the critical elements of NGSS adoption and implementation that are explored in each chapter of the workbook. Each of these critical elements contains a series of guiding questions for discussion and a description of what types of evidence to consider when answering the questions. Completing this assessment with your strategic leadership team before reading further will enable you to identify areas of relative strength and challenge and may help focus preliminary conversations around adoption and implementation planning. The diagnostic questions also appear at the beginning of each chapter to help your state team gauge the extent to which you have already addressed the action(s) in question.

FIGURE 2: Diagnostic Tool

Diagnostic Questions	Types of Evidence To Consider
Strategic Leadership Team	
• Is there a designated strategic leadership team with the focus, tools and skill set needed to drive adoption? • Do members of the strategic leadership team have a shared understanding of the specific details about your state's standards adoption process? • Is there clear ownership of each of the policy elements related to the NGSS? • Is there a clear understanding of the political landscape and levers of influence as they relate to adoption?	• The state education agency has specified a clear point of accountability or defined multiple points of accountability for adopting and implementing the NGSS.
Aspiration	
• Have we articulated a vision for what the NGSS will deliver for every student? • Have we identified how the NGSS contribute to our vision for education and how adoption of the NGSS fits into our state's STEM plan? • Have we identified how the NGSS contribute to our state's economic development strategy? • Is that vision connected to our aspiration for college and career readiness across the state, including efforts to implement the CCSS? • Is that vision shared by a guiding coalition of state leaders, and are we doing enough to maximize the impact of their support? • Does that vision coalesce around the connection between college and career readiness and science? If so, is that aspiration shared? Does the aspiration align with priorities within the system (policies, funding, etc.)? • Can that vision be broken down into measurable goals for improving student outcomes and closing achievement gaps?	• People inside and outside the state education agency can name the aspiration. • External evidence relays the imperatives of adopting the NGSS for the state (e.g., employer demand, future jobs, poor performance), and these imperatives can be relayed by all supporters. • A P–20 focus/effort exists around college and career readiness and science.

Diagnostic Questions	Types of Evidence To Consider
Past and Present Performance	
• Have we arrived at a clear view of our current performance in science relative to subgroups within our state, district comparisons, other states and other countries? • Have we identified key areas of strength and weakness based on this evidence? • Have we analyzed the root causes of students' academic achievement — both successes and areas in need of improvement? • Have we established clear goals for student performance? • Have we identified how much instructional time is devoted to science in K–12? • Have we identified how the current classroom practice aligns to the NGSS shifts? • Based on past and present performance, have we derived implications for our NGSS implementation plan? • What are the workforce projections for our state? How many STEM-capable jobs will be added?	• Participation, scores and/or passage rates on third-party national assessments (e.g., Advanced Placement, International Baccalaureate and dual enrollment) • Course-taking and passage rates for rigorous science courses at the high school level • National Assessment of Educational Progress science proficiency or proficiency on internationally benchmarked science assessments • Closing equity gaps between disadvantaged students and their peers • Rates of proficiency on existing science exams • Number/percentage of high school graduates who enroll in college with the intent of majoring in a STEM discipline • Number/percentage of high school graduates who begin careers in fields that require STEM knowledge and skills (many of which require some postsecondary experience but not a four-year degree) • Number/percentage of college graduates who graduate with majors in a scientific discipline

Diagnostic Questions	Types of Evidence To Consider
State's Role and Approach	
• Is there a designated strategic leadership team responsible for selecting the strategies — a coordinated set of activities designed to achieve our goals in science — and for ensuring delivery? • Is there clear ownership of each of the policy elements related to the NGSS? • Is there a clear understanding of the political landscape and levers of influence as they relate to *adoption?* • Have we identified what districts need for *adoption,* what their highest priorities are and what assistance they need from the state? • Have we identified what the state's role in NGSS *implementation* will be and how it may need to be different from the current state role? • Have we specified strategies for the state's role in NGSS *implementation* that are based on evidence? • Are we confident that the strategies for the state's role in NGSS *implementation* will facilitate the shifts required by the standards in every classroom? • To what extent are the strategies for the state's role in NGSS *implementation* coherent with CCSS implementation, teacher/leader effectiveness work and other significant initiatives? • Have we defined *feedback loops* — evidence that identifies whether implementation is on track — that we can use to monitor the likelihood that this plan will deliver its promised results?	• Those responsible for specific strategies (e.g., instructional materials, professional development, etc.) can name the core priority activities. • Confidence is high that these activities are the ones with the highest potential for impact. • Measures of success have been articulated to determine whether the combination of levers and strategies (e.g., instructional materials, professional development, etc.) has been successful. • Analysis shows how completing this strategy successfully will result in improved outcomes for students.
Targets and Trajectories	
• Do the appropriate leaders have access to the data needed to determine past and present performance? How easy or difficult is pulling historical or real-time data? Is there a culture of using data to shape state goals and track progress against them? • Have we estimated the impact that each of our strategies will have on these goals over time? • Do we have confidence that the strategies will be sufficient to help us achieve our goals?	• There is a shared understanding of the expected baseline for performance. • Specific, measurable, ambitious, realistic and time-limited (SMART) targets have been set for each of the student outcome goals that are defined by the aspiration and based on where performance is now (baseline) and where it has been (historical progress).

Diagnostic Questions	Types of Evidence To Consider
Stakeholder Engagement Strategy	
• Have we created core messages for our adoption and implementation plan? • Have we identified the stakeholders whose support we will need? Do our messages speak to them? • Do we have a plan for engaging stakeholders, including champions in the field and the public at large? • Have we identified our key opponents and their points of opposition, and do we have a strategy for addressing the challenges they may pose?	• Teachers, principals and superintendents in the field understand how their work environments are going to change as a result of the NGSS and are supportive. • Key stakeholders understand their role in supporting adoption and implementation of the standards.
Routines for Monitoring Progress	
• Have we established regular performance dialogues to monitor our progress toward achieving our goals and the likelihood that we will achieve them in the future? • Is there clear ownership of each of the policy elements related to the NGSS? • Do these routines rely on a broad evidence base, including the feedback loops in the implementation plan, to arrive at a regular and shared view of progress? • Do these routines help leaders identify and solve the most challenging problems as they arise? • Do these routines build on established processes and mechanisms for management that are already in place? • Do we regularly communicate our progress/decisions internally to the state education agency and externally to those interested and/or affected (e.g., districts, state board, key legislators)?	• Performance data are frequently discussed by the system leader and those who are accountable at the state education agency. • Performance dialogues are regular and/or consistent — from the point of view of the chief and the point of view of those accountable. • In the course of a given month, the routines give the system leader the right performance information at the right level of depth to drive decisionmaking.

EXERCISE 2: Review Capacity To Adopt and Implement the NGSS

Objective(s) for participants:

- Arrive at a consensus on current areas of strength and challenge in the critical elements of NGSS adoption and implementation.

Instructions:

- Read through the diagnostic tool and take notes individually on evidence of strength or challenge for each critical element.
- Determine who has access to/holds the evidence.
- Use the evidence to arrive at an individual rating for each critical element.
- Share individual ratings (weak = 1 to strong = 4) with the group by marking on flipchart paper.
- Discuss and come to consensus as a group on areas of relative strength and challenge across the critical elements.

Materials needed:

- Copies of the diagnostic tool for each participant
- Flipchart paper and/or handouts with the template
- Markers

Exercise notes:

- Guiding questions for discussion:
  - What were some of the strongest ratings? What was the evidence behind them? What were the weakest ratings and their evidence?
  - Does our evidence match our ratings across elements? What adjustments do we need to make?
  - What does this tell us about where we need to focus?
- You may not need to bring the group to complete consensus; the discussion and agreement on evidence is more important than any specific rating.

Template for Exercise 2

Element	Rating (1–4)	What Is the Evidence — and What Is the Level of Transparency and Access to the Evidence?
Aspiration		
Past and present performance		
State's role and approach		
Targets and trajectories		
Stakeholder engagement strategy		
Routines for monitoring progress		
Other		

Step 3: Establish an Adoption and Preliminary Implementation Timeline

A timeline is a useful tool for giving a broad overview of your plan; it should reflect your state's strategy for incorporating these standards into the full range of education reforms unfolding in your state. As such, it is also a vital mechanism for communicating your adoption and implementation plan while making the case for adoption.

Developing this high-level implementation plan *prior* to adoption means anticipating the questions that policymakers and stakeholders will have about the timing, sequence and plan for implementation of the new standards. States should be careful not to underestimate what a preliminary implementation plan entails; it goes far beyond a timeline with teaching and assessment dates. This plan should be perceived as a living document that will change over time; it should be used to help structure and guide more detailed planning, especially as many areas are still under transition (e.g., science assessment, teacher evaluation, accountability). These areas may not be appropriate for inclusion today but will be important to improve the coherence of the overall NGSS effort in the future.

There are four major issues to consider in creating a timeline. First, what are the broad and general milestones? For example, does your team understand your state's associated legal and legislative requirements for adopting new content standards (e.g., public hearings, feedback windows, fiscal impact analysis)? Second, what are the key milestones for each? If you have not done so already, defining these key milestones will help you further flesh out your strategies and form a view of how they fit together with each other and with your general milestones. Third, consider the rollout of your strategies. Most states do not implement standards in all grades simultaneously — but what is the best way for your state to sequence implementation? Be sure to consider pros and cons to each option and be able to support the decision with appropriate data and messaging. Options include:

- The state could roll out the standards in the early grades and incrementally add a new grade each year.
- The state could roll out the standards at key transition grades (K, 6 and 9) and then subsequently add three new grades per year.
- The state could focus its rollout on the middle grades (6–8) and then move to K–5 and 9–12.
- The state could stagger implementation by starting earlier in voluntary pilot districts and then moving statewide.

Fourth, leaders from across the state education agency and broader education stakeholders will be implicated in this work; engaging in this process will help you identify where those connections exist to strengthen communication and collaboration among leaders and managers responsible for moving the work forward.

These milestones can include, but are not limited to:

- Formal adoption of the standards:
  - Identification of the strategic leadership team;
  - Research on specific details about your state's standards adoption process, rules, etc.;
  - Fulfillment of any associated legal and legislative requirements (e.g., public hearings, feedback windows, fiscal impact analysis);
  - Identification of the target date for adoption; and
  - Adoption of the standards by the state board, legislature or appropriate authority.
- Definition of your aspiration for what the NGSS will accomplish in your state:
  - Understanding of what the NGSS will require;

- Development of a vision for what the NGSS will accomplish for students and for your state; and
- Sharing of your vision with key stakeholders in your state and refinement of your vision.

- Evaluation of past and present performance in science in your state:
  - Gathering of the relevant data;
  - Distillation of key performance patterns and identification of root causes; and
  - Identification of implications for adoption and implementation.
- Development of a stakeholder engagement strategy for adoption and implementation of the NGSS:
  - Development of key three messages;
  - Identification and analysis of the stakeholders who are most critical to successful adoption and implementation;
  - Building of your guiding coalition;
  - Establishment of a process and plan to handle potential challenges; and
  - Development of a stakeholder outreach strategy.
- Establishment of routines and solving of problems:
  - Reflection on existing performance management routines and consideration of how they can be adapted to monitor the progress of NGSS implementation; and
  - Organization of, preparation for and conducting of routines.
- Other policy changes (e.g., course credit, graduation requirements).
- Alignment with/creation of a STEM plan for your state (e.g., integration with STEM efforts, including increasing access to STEM courses/pathways for all students).
- Development of educator preparation that reflects the NGSS, including preservice, in-service and licensure.
- Transition of assessment practices, including formative, summative and high-stakes exit exams.
- Transition of the accountability system.

There is no one-size-fits-all approach to establishing a timeline. To determine the best approach for your state, it will be important to consider implications for curricular transitions, budget and other drivers that may create specific urgency. For example, state leaders will need to determine how to reallocate or realign funding streams to support implementation of the NGSS and ensure that professional development and other supports are aligned to the NGSS. These processes will have an impact on the implementation timeline in each state.

EXERCISE 3: Establish Your Adoption and Preliminary Implementation Timeline

Objective(s) for participants:

- Create an adoption and working implementation timeline for the NGSS.

Instructions:

- Identify the broad and general milestones that must occur during your adoption and implementation, using the list in this chapter as a reference. Record those milestones on the flipchart.
- Identify the key milestones for each critical element and discuss the ideal order for those milestones.
- Record the milestones where they belong on the flipchart.
- Reflect on the overall timeline and discuss:
  - Do the elements and action steps fit together properly?
  - Does the timeline take into account resource availability?
  - Does the timeline take into account other major events?

Materials needed:

- Flipchart
- Markers
- Sticky notes (optional)

Exercise notes:

- You may wish to place milestones on sticky notes first, so you can move around the order more easily as the discussion evolves.

Template for Exercise 3

Critical Elements and Action Steps	Responsible Party	Role of Strategic Leadership Team	Winter 2013	Spring 2013	Summer 2013	Fall 2013	Winter 2014	Spring 2014
Formal adoption of the standards								
Identification of the strategic leadership team								
Research on specific details about our state's standards adoption process, rules, etc.								
Fulfillment of any associated legal and legislative requirements (e.g., public hearings, feedback windows, fiscal impact analysis)								

Critical Elements and Action Steps	Responsible Party	Role of Strategic Leadership Team	Winter 2013	Spring 2013	Summer 2013	Fall 2013	Winter 2014	Spring 2014
Identification of the target date for adoption								
Adoption of the standards by the state board, legislature or appropriate authority								
Definition of our aspiration for what the NGSS will accomplish in our state								
Understanding of what the NGSS will require								
Development of a vision for what the NGSS will accomplish for students and for our state								
Sharing of our vision with key stakeholders in our state and refinement of our vision								
Evaluation of past and present performance in science in our state								
Gathering of the relevant data								
Distillation of key performance patterns and identification of root causes								
Identification of implications for adoption and implementation								
Development of a stakeholder engagement strategy for adoption and implementation of the NGSS								
Development of key three messages								
Identification and analysis of the stakeholders who are most critical to successful adoption and implementation								
Building of our guiding coalition								

Critical Elements and Action Steps	Responsible Party	Role of Strategic Leadership Team	Winter 2013	Spring 2013	Summer 2013	Fall 2013	Winter 2014	Spring 2014
Establishment of a process and plan to handle potential challenges								
Development of a stakeholder engagement strategy								
Establishment of routines and solving of problems								
Reflection on existing performance management routines and consideration of how they can be adapted to monitor the progress of NGSS implementation								
Organization of, preparation for and conducting of routines								
Other policy changes (e.g., course credit, graduation requirements)								
Alignment with/creation of a STEM plan for our state								
Development of educator preparation that reflects the NGSS, including preservice, in-service and licensure								
Transition of assessment practices, including formative, summative and high-stakes exit exams								
Transition of the accountability system								

Chapter 2: Define Your Aspiration

Questions from Diagnostic Tool

- Have we articulated a vision for what the NGSS will deliver for every student?
- Have we identified how the NGSS contribute to our vision for education and how adoption of the NGSS fits into our state's STEM plan?
- Have we identified how the NGSS contribute to our state's economic development strategy?
- Is that vision connected to our aspiration for college and career readiness across the state, including efforts to implement the CCSS?
- Is that vision shared by a guiding coalition of state leaders, and are we doing enough to maximize the impact of their support?
- Does that vision coalesce around the connection between college and career readiness and science? If so, is that aspiration shared? Does the aspiration align with priorities within the system (policies, funding, etc.)?
- Can that vision be broken down into measurable goals for improving student outcomes and closing achievement gaps?

At first glance, aspirations may seem superfluous to the adoption and implementation of the NGSS. Leaders involved in change efforts know why they are making this change, but an aspiration is not a meaningful goal unless and until it is shared and held in common — by leaders, outside stakeholders and practitioners in the field. A shared aspiration must first be defined and articulated.

As noted in the introduction, the NGSS represent a major shift in the way science is taught in most classrooms. A shared aspiration will be important in your state's efforts to build the necessary coalition for adoption 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 NGSS — one that will anchor decisions about strategy and implementation down the road.

Action Steps

Step 1: Develop a vision for how the NGSS will affect students and your state.
Step 2: Understand what the NGSS will require.

Step 1: Develop a Vision for How the NGSS Will Affect Students and Your State

The NGSS will transform science instruction to make it relevant for students' lives — and ultimately improve science performance. Given the interest of policymakers, business and higher education to expand the STEM-capable workforce, the fact that you are undertaking the challenge to better prepare K–12 students for these options is likely to win you support. You need to be able to show where the NGSS can take your students. This vision is a critical piece of your case for adoption, and it will guide and shape your work in implementation.

A good vision for NGSS will answer five questions:

- What are we trying to accomplish for our students and why?
- How will we know that we have done it?
- What is holding us back from getting there?

- Why and how are the NGSS essential to our success?
- How do the NGSS fit into our overall STEM agenda and more broadly the economic development and growth agenda for our state?

What are we trying to accomplish for our students and why? Every state will have its own take on how best to answer this question, but a core principle is the vision that science competency unlocks the larger aspiration of college and career readiness. In fact, for many experts, the idea of college and career readiness simply cannot be separated from scientific literacy. With this in mind, the NGSS authors have developed a working definition of college and career readiness in science — shown in Figure 3 — which may be useful as you consider this question.

FIGURE 3: An Initial Draft Definition of College and Career Readiness in Science[2]

College- and Career-Ready Students can demonstrate evidence of:

- Applying a blend of Science and Engineering Practices, Crosscutting Concepts and Disciplinary Core Ideas (DCIs) to make sense of the world and approach problems not previously encountered by the student, new situations, new phenomena, and new information;
- Self-directed planning, monitoring and evaluation;
- Applying knowledge more flexibly across various disciplines through the continual exploration of Science and Engineering Practices, Crosscutting Concepts and DCIs;
- Employing valid and reliable research strategies; and
- Exhibiting evidence of the effective transfer of mathematics and disciplinary literacy skills to science.

This working definition of college and career readiness in science is based on the following assumptions:

- As indicated in *A Framework for K-12 Science Education*, students are expected to operate at the nexus of the three dimensions of science: 1) Science and Engineering Practice; 2) Crosscutting Concepts; and 3) DCIs.
- The learning expectations are equivalent for college and career.
- A student is ready to enter and succeed in coursework beyond high school in science and technical subjects that leads to a degree or credential. This includes the military and credentialing that can occur during the high school experience such as credentialing programs, dual enrollment programs and advanced placement courses.

And why do you want your students to be college and career ready in science? The reasons will vary from state to state, but here are some of the most common:

The economic imperative: The 21st century workforce continues to move toward one that demands an increased proficiency in science, technology, engineering and mathematics in all fields as well as traditional STEM fields. During the recession of the mid- to late 2000s, postings for STEM jobs outnumbered the STEM unemployed.[3] Even when the United States fills STEM jobs, businesses rely heavily on foreign-born workers to fill these positions rather than finding the skilled labor on the nation's shores. What's more, in the last 60 years, the percentage of foreign-born workers filling STEM positions has more than doubled — from 7 percent in 1950 to 17 percent in 2008.[4] Are there dominant industries in your state that depend on core science skill sets in their employees? Is it imperative that they be able to find the skilled high school and college graduates they need for these roles within your

[2] *APPENDIX C – A DRAFT Definition of College and Career Readiness in Science.* (Updated January 2013). Available at www.nextgenscience.org/sites/ngss/files/Appendix C - A DRAFT Definition of College and Career Readiness in Science - FINAL.pdf
[3] Change the Equation. (2012). *STEM Help Wanted: Demand for Science, Technology, Engineering and Mathematics Weathers the Storm.* Available at http://changetheequation.org/sites/default/files/CTEq_VitalSigns_Supply (2).pdf
[4] Carnevale, A.P., Smith, N., & Melton, M. *STEM.* (2011). Washington, DC: Center on Education and the Workforce.

state? What do your state's economic/job projection data say? What do your employers tell policymakers they need? What are your state's economic development ambitions? Remember that STEM jobs are not just for STEM graduates from four-year programs. Importantly, the number of STEM jobs is growing at every level, from postsecondary certification programs to those that require advanced degrees.

The competition imperative: Regardless of the situation inside your state's borders, these changing requirements for careers are a global phenomenon. How important is it for your state to compete for these jobs? How important is it for your graduates, as other states and other countries improve their systems of science education, to meet this challenge?

The equity imperative: True scientific literacy has historically been the province of more privileged students — something reserved for the "gifted" rather than a requirement for all. We cannot close the college and career readiness gap without giving every student the opportunity to build his or her skills in scientific practices — practices that will apply both in and beyond STEM fields. White men still dominate the science and engineering workforce, accounting for 55 percent of those in science and engineering occupations. White women make up 18 percent of those employed in science and engineering occupations. Black men and women comprise just 3 percent of the scientists and engineers in science and engineering occupations; Hispanic men and women comprise just 4 percent.[5]

The informed citizen imperative: Science — and therefore science education — is central to the lives of all Americans, preparing them to be informed citizens in a democracy and knowledgeable consumers in a world fueled by innovations in science and technology.

How will we know that we have done it? Reflecting on the question of what you are trying to accomplish for your students and why will help you answer the question of how you will know you have done it. This is where you establish specific goals for science education in the context of your overall goals for education in your state. Simply defined, a goal translates the vision defined above into a series of specific measures. You do not need to get into detail about exact targets and dates at this point, but you need to establish goals that you know you will be able to measure and put numbers on in the future. Some examples of goals to consider:

- Increasing participation, scores and/or passage rates on third-party national assessments (e.g., Advanced Placement, International Baccalaureate and dual enrollment);
- Increasing course-taking and passage rates for rigorous science courses at the high school level;
- Improving National Assessment of Educational Progress science proficiency or proficiency on internationally benchmarked science assessments (e.g., the Trends in International Mathematics and Science Study);
- Increasing the number and percentage of high school graduates who enroll in postsecondary programs with the intent of acquiring a STEM credential or majoring in a STEM discipline;
- Increasing the number and percentage of high school graduates who begin careers in fields that require STEM knowledge and skills (many of which require some postsecondary experience but not a four-year degree);
- Increasing proficiency over time on science assessments aligned to the NGSS;
- Increasing the number and percentage of college graduates who graduate with majors in a scientific discipline;
- Closing equity gaps between disadvantaged students and their peers on any of the above measures; and

[5] National Science Foundation, Division of Science Resources Statistics. (2011). *Women, Minorities, and Persons with Disabilities in Science and Engineering: 2011.* Special Report NSF 11-309. Arlington, VA. Available at http://www.nsf.gov/statistics/wmpd/

- An index that aggregates and/or weights two or more of the above measures.

What is holding us back from getting there? Once you have established your goals, you are ready to reflect on the third question. What are the greatest areas of weakness in current practice and instruction? What deeply ingrained beliefs may impose a constraint? How will these things stand in the way of achieving the broad vision you have articulated?

Why and how are the NGSS essential to our success? The first three questions thus set up the problem that the NGSS are there to solve — and this question makes this solution explicit. From what you know about the NGSS, can you make the case for how they will help you confront the unique challenges your state faces? This is an opportunity to explain, in language that resonates in your state, why the conceptual shifts in the NGSS are essential to improving student performance.

How do the NGSS fit into our overall STEM agenda and more broadly the economic development and growth agenda for our state? The final key question to consider is one that will help place the NGSS within your state's broader STEM goals, including K–12, postsecondary, and economy- and business-related goals — thus improving the coherence of your state's STEM agenda across the pipeline.

For example, suppose that you know that engineering is a major jobs growth area for industries in your state and that, accordingly, your state has set a goal of doubling the number of high school and college graduates with engineering credentials. Going back to the conceptual shifts, you might realize that engineering is not a familiar concept in most of the major educator preparation programs in your state and that it is not emphasized in current K–12 coursework. Engineering literacy, then, has just become the watchword of your campaign for NGSS adoption and implementation because it is something that your state needs that the NGSS, properly implemented, can deliver.

EXERCISE 4: Articulate Your NGSS Vision

Objective(s) for participants:

- Answer the five key questions to develop the vision for what the NGSS will accomplish for students in the state.

Instructions:

- Consider the five key questions and any reference materials or evidence associated with each of them.
- Discuss each of the five questions in turn and record the answers on the flipchart template:
  - What are we trying to accomplish for our students and why?
  - How will we know that we have done it?
  - What is holding us back from getting there?
  - Why and how are the NGSS essential to our success?
  - How do the NGSS fit into our overall STEM agenda and more broadly the economic development and growth agenda for our state?
- Discuss and agree on a concise answer to each question.

Materials needed:

- Copies of questions to consider for each participant
- Flipchart paper
- Markers

Exercise notes:

- A great deal will depend on context and evidence to consider for each of the five questions.
- It will be critical for participants to bring information about their broader environment to consider. For example:
  - Public statements from policymakers about aspirations for the state (e.g., the governor's economic development agenda);
  - Strategic plans or visions developed for the state for college and career readiness in general and/or science in particular;
  - Studies and/or other research on the economic or business landscape in your state regarding STEM skills, current science standards and practices, etc.;
  - State-specific STEM plans; and
  - Documentation on the NGSS and the conceptual shifts.
- Consider splitting the team into groups to consider the five questions, and have the groups compare answers.
- Consider assigning the writing of "concise answer" statements to one person or a smaller team after the exercise is completed and general agreement is reached.

Template for Exercise 4

Question	Potential Answers
What are we trying to accomplish for our students and why?	
How will we know that we have done it?	
What is holding us back from getting there?	
Why and how are the NGSS essential to our success?	
How do the NGSS fit into our overall STEM agenda and more broadly the economic development and growth agenda for our state?	

Step 2: Understand What the NGSS Will Require

To effectively articulate an aspiration, your state strategic leadership team will need to be grounded in a clear understanding of the NGSS; what the standards require of students, educators and education systems; and how those requirements compare to what you are already doing in your state. This is not meant to be a "crosswalk" exercise, in which old standards are compared to new. *In fact, the NGSS are sufficiently different in architecture and demand that a traditional crosswalk would be meaningless.* Still, the question of how your state's old science standards compare to the new will be asked, and your state must be well prepared to respond. Understanding what the NGSS are, the overall shifts they will require, what will be most challenging for your state, and what the implications will be for both adoption and implementation is critical. Ironically, the things that may be hardest (e.g., integrating practice and content) will also be the things that create the most value for your students; as such, they will become a key part of the case that you make for adoption.

So what is different about the NGSS? Figure 4 gives a summary; for more in-depth information, go to the NGSS website at www.nextgenscience.org.

FIGURE 4: An Introduction to the NGSS

The overarching shift demanded by the NGSS is a change in the meaning of scientific proficiency. Students will demonstrate their proficiency in science not by recalling specific facts but by engaging in actual scientific practices that demonstrate the ability to apply scientific concepts and ideas in any context. Effective science teaching and learning comes from the combination of engaging in Disciplinary Core Ideas through Science and Engineering Practices, frequently in the context of Crosscutting Concepts. As such, the NGSS are organized around three dimensions:

- **Disciplinary Core Ideas** that are acquired by students through an overall K–12 learning progression and can be taught at increasing levels of depth and complexity over time.
- **Science and Engineering Practices,** like developing and using models or analyzing and interpreting data, that are critical to scientific inquiry in any content area. These are not teaching strategies; they are a necessary student outcome to show proficiency in science.
- **Crosscutting Concepts,** like patterns and cause and effect, that provide the connective tissue between sciences. These concepts are found throughout all scientific disciplines and will be continually revisited and built on through the exploration of core content.

At their core, the NGSS are defined and set apart by their focus on the blending of these three dimensions and the coherence between them. A student who can demonstrate understanding of these three dimensions as portrayed as performance expectations is literate in science. An example of each is given below.

Sample Draft Kindergarten Standard PS1-a: Matter and Its Interactions		
Students who demonstrate understanding can: **K-PS1-a** **Design and conduct an investigation of different kinds of materials to describe their observable properties and classify the materials based on the patterns observed.** [Clarification Statement: Observations are qualitative only and could include relative length, weight, color, texture and hardness. Patterns include the similar properties that different materials share.]		
The performance expectation above was developed using the following elements from the National Research Council's document *A Framework for K-12 Science Education.*		
Science and Engineering Practices	**Disciplinary Core Ideas**	**Crosscutting Concepts**
Planning and Carrying Out Investigations Planning and carrying out investigations to answer questions or test solutions to problems in K–2 builds on prior experiences and progresses to simple investigations, based on fair tests, which provide data to support explanations or design solutions. ▪ With guidance, design and conduct investigations in collaboration with peers. ▪ Make direct or indirect observations and/or measurements to collect data which can be used to make comparisons. --- ***Connections to Nature of Science*** **Science Knowledge is Based on Empirical Evidence** ▪ Scientists look for patterns and order when making observations about the world.	**PS1-a: Structure and Properties of Matter** ▪ Different kinds of matter exist (e.g., wood, metal, water), and many of them can be either solid or liquid, depending on temperature. ▪ Matter can be described and classified by its observable properties (e.g., visual, aural, textural), by its uses, and by whether it occurs naturally or is manufactured.	**Patterns** ▪ Patterns in the natural and human designed world can be observed, used to describe phenomena and used as evidence.
Common Core State Standards Connections: *Mathematics* **K.MD.1** Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object. **K.MD.2** Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.		

How is this different from current science expectations in most states? The NGSS authors have defined six conceptual shifts that the standards require for faithful implementation:

- **K–12 science education should reflect the interconnected nature of science as it is practiced and experienced in the real world.** Most state and district standards express the three dimensions as separate entities, leading to their separation in both instruction and assessment. The NGSS expectations for both students and teachers are that they will engage at the nexus of these three dimensions, applying practices to content knowledge and making use of Crosscutting Concepts to do so.

- **The NGSS are student performance expectations — NOT curriculum.** The Disciplinary Core Ideas themselves form a progression of knowledge for students that is clearly laid out in the NGSS, but the Science and Engineering Practices and Crosscutting Concepts should not be limited to specific time periods of instruction. Rather, educators and students should return to the Science and Engineering

Practices and Crosscutting Concepts again and again, applying them to every Disciplinary Core Idea so that content knowledge progression is accompanied by skill development in the application of scientific practices and concepts. Simply said, the NGSS form the basis for student performance. Curriculum materials are state and local decisions that will encompass the order and day-to-day instructional needs to prepare students for the performances.

- **The science concepts in the NGSS build coherently from kindergarten through grade 12.** The focus on a few Disciplinary Core Ideas is a key aspect of a coherent science education. Historically, science education has been taught as a set of disjointed and isolated facts. The NGSS provide a more coherent progression aimed at overall scientific literacy, with instruction focused on a smaller set of ideas but with an eye on what the student should have already learned and what he or she will learn at the next level. These progressions for each grade band assume that the necessary previous material has been learned by the student.
- **The NGSS focus on deeper understanding of content as well as application of content.** Within the Disciplinary Core Ideas, the focus of the NGSS is on conceptual understanding — not just the facts that are associated with them. The facts and details are important evidence but can no longer be the sole focus of instruction. *A Framework for K-12 Science Education* casts this shift in terms of the difference between novices and experts: "Experts understand the core principle and theoretical constructs of their field, and they use them to make sense of new information or tackle novel problems. Novices, in contrast, tend to hold disconnected and even contradictory bits of knowledge as isolated facts and struggle to find a way to organize and integrate them." The NGSS aim to make students experts rather than novices.
- **Science and engineering are integrated in science education from kindergarten through grade 12.** Unlike the traditional science disciplines, engineering has not routinely been included in state science standards, curricula or assessments or as a component of the education of new science teachers. The NGSS integrate engineering into the structure of science education by raising engineering design to the same level as scientific inquiry in classroom instruction and by giving core ideas of engineering and technology the same status as those in other major science disciplines.
- **The NGSS make explicit connections to the CCSS (English language arts/literacy and mathematics).** The release of the NGSS comes as most states are implementing the CCSS. This creates an opportunity for science to be part of a child's comprehensive education. The NGSS take into account the content and performance expectations of the CCSS to ensure a symbiotic pace of learning in all content areas and specifically refer to related standards in the CCSS.

The NGSS are a product of both research and an understanding of best practices across states. Once your state understands the difference between your current standards and the NGSS and the conceptual shifts demanded, you can prioritize the biggest lifts for your state and articulate why these priorities will make the most difference for your students.

You may, for example, discover that your current standards' core ideas are sufficiently focused, clear and sequenced, such that the transition to Disciplinary Core Ideas will be relatively easy. At the same time, however, you may find that the integration of scientific practices into this material, particularly engineering design, is completely absent from both the letter and practice of science education in your state. This will be a big shift — but it can also serve as a rallying point. The absence of real practices in science education, you can argue, will leave your students unprepared for careers in these fields. It is a gap in your state's expectations that must be closed.

As you consider each of the shifts, it is helpful to focus on the implications for educator and student practice. Figure 5 gives some questions to consider.

FIGURE 5: Implications of NGSS Conceptual Shifts for Educators and Students

Shift	Questions To Consider
K–12 science education reflects the real-world interconnections in science.	• What do our current science standards require with respect to this shift (i.e., what is our baseline)? • Do our current science standards require students to demonstrate understanding by applying specific scientific practices and crosscutting concepts to core content knowledge and its acquisition? • Do our science educators emphasize this application in their expectations, instruction and assessment of students? • Do our schools and support systems facilitate collaboration among science educators to demonstrate the reach of scientific practices and crosscutting concepts across the core ideas in the disciplines? • Do we have a plan to ensure that our statewide summative science assessments are aligned to the NGSS?
All practices and crosscutting concepts are used to teach core ideas all year.	• Do our current science standards require students to build skills in scientific practices and crosscutting concepts by focusing on them — and connecting them to content — throughout each school year? • Do our science educators teach science practices and core concepts as a progression of core content rather than in addition to it? Do they use these practices and concepts to build in-depth student understanding in the context of the content areas covered throughout the school year? • Do our schools and support systems equip and encourage educators to plan their lessons in this way? • Do schools and teachers have access to the consumable physical materials (beyond textbooks/curriculum materials) to prepare and execute the classroom investigations and design work required by the NGSS?
Science concepts build coherently across K–12.	• Do our current science standards lay out expectations for student scientific knowledge as a progression across grades, or do they expect the same content (or unrelated content) to be taught across multiple years? • Do our science educators treat science content as a cumulative body of knowledge built year by year? Can they assess students' prior knowledge and take appropriate remedial action? • Do our schools and support systems emphasize the collaboration of educators across grade levels to ensure this progression of knowledge for their students?
The NGSS focus on deeper understanding and application of content.	• Do our current science standards expect students to master scientific core ideas and principles (e.g., "molecules are made up of atoms, and have different properties depending on their combination") and use them in multiple contexts, rather than memorizing particular facts or details with little or no context (e.g., "the molecule CO, carbon monoxide, is a poisonous gas")? • Can our science educators emphasize a deep understanding of core ideas,

	sometimes at the expense of particular details associated with those ideas? • Do our schools and support systems give educators what they need to keep coming back to and focusing on these Disciplinary Core Ideas?
Science and engineering are integrated in science education from kindergarten through grade 12.	• Do our current science standards require students to use engineering design ideas and practices alongside the traditional science disciplines from kindergarten through grade 12? • How comfortable are our current and candidate science educators with engineering design? Do they raise it to the same level as scientific inquiry as a core practice in science instruction? Do they give core ideas of engineering and technology equal weight with those in other disciplines? • Do our schools and support systems prepare our educators to teach engineering design and the core ideas of engineering and technology? Is this reflected in policy/funding for course offerings and their content?
Science standards coordinate with the CCSS in English language arts/ literacy and mathematics.	• Are our current and candidate science teachers aware of and knowledgeable about the CCSS? • Do our schools and support systems allow and encourage collaboration across scientific and nonscientific disciplines in the teaching of literacy, numeracy and science?

EXERCISE 5: Determine the Biggest NGSS Shifts for Your State

Objective(s) for participants:

- Arrive at a consensus on which NGSS conceptual shifts are more or less challenging for students and educators in the state.

Instructions:

- Individually read through and reflect on the "questions to consider" in Figure 5.
- Discuss and come to consensus on which one to two shifts represent the *heaviest lift* for the state and which one to two shifts represent the *lightest lift.*
- Using the flipchart template, discuss and record reflections on the shifts that are the *heaviest lift:*
  - Why are these shifts the *heaviest lift,* and what are potential leverage points to intervene?
  - What would happen if we successfully made these shifts?
  - How can we use these areas of relative weakness to make the case for NGSS adoption?
- Using the flipchart template, discuss and record reflections on the shifts that are the *lightest lift:*
  - Why are they the *lightest lift*?
  - How can we use these areas of relative strength to build momentum for NGSS adoption?

Materials needed:

- Copies of questions to consider for each participant
- Flipchart paper
- Markers

Template for Exercise 5

Shift	Heavy or Light Lift and Rationale for Why	For Heavy Lifts, Impact If We Successfully Make These Shifts	For Heavy Lifts, Areas of Relative Weakness To Make the Case for NGSS Adoption	For Light Lifts, Areas of Relative Strength To Build Momentum for NGSS Adoption

Conclusion

As noted at the beginning of this chapter, an aspiration may seem trivial, but it is critical. It is arguably the cornerstone of your case for adopting the NGSS. Moreover, it is the foundation for your entire implementation plan. An aspiration will keep your end goal at the forefront and will focus your efforts. With a clear aspiration in hand, you are ready to dig into your state's current and previous performance in science and to use this information to set a baseline for the work ahead.

Chapter 3: Evaluate Past and Present Performance

Questions from Diagnostic Tool

- Have we arrived at a clear view of our current performance in science relative to subgroups within our state, district comparisons, other states and other countries?
- Have we identified key areas of strength and weakness based on this evidence?
- Have we analyzed the root causes of performance — both successes and areas in need of improvement?
- Have we established clear goals for student performance?
- Have we identified how much instructional time is devoted to science in K–12?
- Have we identified how the current classroom practice aligns to the NGSS shifts?
- Based on past and present performance, have we derived implications for our NGSS implementation plan?
- What are the workforce projections for our state? How many STEM-capable jobs will be added?

As the old cliché goes, you have to know where you have been to know where you are going. Your aspiration has set out the endpoint; to plot the course to it, you will need a clear understanding of your starting point as well. This means digging into your data and other evidence on science instruction and performance — especially those data that are likely to become the basis for measuring the student outcome goals in your aspiration. By establishing a clear and shared view of current performance, you will build the case for the types of strategies that will be most important to pursue for your state. You will also, if necessary, back up the claims in your aspiration with quantitative evidence.

Action Steps

Step 1: Gather the relevant data.
Step 2: Distill key performance patterns and identify root causes.
Step 3: Identify implications for adoption and implementation.

Step 1: Gather the Relevant Data

There are four kinds of data that you can gather, identified by two criteria. First, what is being measured? Outcomes are those measures that are direct measurements of one or more goals for student outcomes, while inputs are leading indicators of those outcomes. Outcomes are obviously the most important measure, but inputs can be useful to measure if they can be directly linked to outcomes and/or they are available more frequently than the outcome measures. A table of potential measures of science performance is given in Figure 6.

FIGURE 6: Potential Measures of Science Performance

Outcomes
• Proficiency results for state science exams • Proficiency results for state math exams • Advanced Placement/International Baccalaureate/dual enrollment science results • National Assessment of Educational Progress (NAEP) science results • Trends in International Mathematics and Science Study results (and link to NAEP results) • Program for International Student Assessment (PISA) science results (and link to NAEP results) • Assessment results for science • Workforce development measures • Percentage of college-bound high school seniors intending to major in a STEM field • Percentage of high school graduates entering a STEM field directly • Percentage of two- or four-year college graduates entering a STEM field • Percentage of students earning STEM-related licenses or certifications • Student interest and self-efficacy in science and engineering • Drop and failure rate in introductory postsecondary science courses
Inputs
• Advanced Placement/International Baccalaureate/dual enrollment science participation • Course-taking rates for lab science and/or other college- and career-ready course of study in science • Percentage of STEM teachers with an in-field credential • Teacher evaluation system results for STEM teachers • Time devoted to instruction • STEM demand in state and job growth in STEM fields

These data will help you understand how large the challenge will be to help your students meet the expectations of the new standards. Moreover, the research behind the NGSS suggests that faithful implementation of the new standards will likely have a substantial and measurable impact on any and all of the above measures.

Second, what type of data are you using? Quantitative data consist of numerical data that are valid to some reasonable standard (e.g., standardized test scores, graduation or attendance statistics). Qualitative data are less statistically valid — they can include spot checks, interviews, information from focus groups and site visits, review of student and educator artifacts, and other "impressions" — but they can be easier to collect. Particularly in the case of qualitative data, your state should look to leverage state and national partners and third-party organizations to collect these data, avoiding relationship biases that might otherwise cloud the quality of the data.

EXERCISE 6: Identify Measures of Science Performance

Objective(s) for participants:

- Agree on a prioritized list of measures to serve as the basis for the analysis of past and present performance.

Instructions:

- Look at the student outcome goals for science (from Exercise 4 in the previous chapter or some other source).
- Discuss and fill in the flipchart template: What are some potential measures to assess these goals?
- Prioritize goals and measures based on importance, availability of data and mix of outcome/input/quantitative/qualitative.

Materials needed:

- List of current student outcome goals for science (if available)
- Flipcharts
- Markers

Exercise notes:

- Because this exercise is meant to identify data for analysis right now, it is important to prioritize measures for which the data/evidence are already available and can be collected easily.
- Depending on whether there are already student outcome goals for science, you may need to spend some time identifying goals at the beginning (again, see Exercise 4 in the previous chapter).

Template for Exercise 6

		What Is Being Measured	
		Outcomes	**Inputs**
Type of data	Quantitative		
	Qualitative		

Step 2: Distill Key Performance Patterns and Identify Root Causes

Gathering evidence is a good first step, but the raw data alone will not be enough. Your team will need to analyze the information and draw conclusions about your areas of strength and weakness regarding science performance. Moreover, your team will need to understand the root causes of this performance — which in some cases are driven by state policies — so that you can build on your strengths and address your weaknesses. Making this transition from raw data to insight is a critical and often-overlooked step in the process.

We will begin by isolating performance patterns in your evidence. A performance pattern is simply an unusual variation (or unusual consistency) in your data that helps you identify a particular area of strength and/or challenge. Quantitative data on student outcomes are usually best for this part of the process.

For example, you may notice that the percentages of students deemed proficient on your science assessment are consistently lower for your economically disadvantaged students than for their nondisadvantaged peers. You dig into the data and find that this achievement gap persists across every grade level in which the exam is given. Moreover, you find that this gap is bigger than the gaps for every other significant subgroup in your state. You have just identified a pattern that is a weakness for you. At the same time, you might find that some districts or schools are exceptions to the rule, with achievement gaps that are much smaller than the state average. These exceptions also constitute an important performance pattern: a set of schools that demonstrate that science can be a discipline for all students to master.

As this example demonstrates, the key to finding performance patterns is to use the power of comparisons, and even comparisons of comparisons, among students, schools and districts in your data. Where do you begin? Beginning with a hypothesis is helpful. Good data analysis borrows some of its core tenets from scientific methodologies: It involves a consistent cycle of hypotheses about the data, use of the data to test hypotheses, evaluation of the results and revision/revisiting of the hypotheses.

Your hypotheses about performance will help you decide which comparisons of the data to do first. While there is no one correct way to analyze data, a few critical comparisons will help you to get started:

Against history: How are we performing today versus our performance in the past? What is the trend over time?

Among schools and districts: Which schools/districts are consistently outperforming the state average? Which are consistently underperforming?

Among subgroups: What are the largest and smallest achievement gaps? How do they compare across districts and schools and against history?

Against other states and countries: Where does our performance place us in the ranking of other states and countries? Can we draw any inferences about our likely performance against the NGSS? What does that tell us about how far we have to go?

With these analyses in front of you, you will be able to validate or reject your initial hypotheses about performance patterns. These results may lead you to form other hypotheses, which can hopefully be tested by other analyses. As you continue this work, you should eventually home in on a few key patterns that characterize science performance in your state.

Once you have identified a few key performance patterns, you will be in a good position to ask why they exist. Why is science performance strong in some areas but weak in others? What implications do these root causes of performance have for the strategies that you will select to achieve your goals? Again, the cycle of hypothesis and examination of the data will be beneficial. Just as you can form hypotheses about overall performance patterns, you can form hypotheses about the root causes of those performance patterns.

The big difference is that the inquiry phase might take you beyond the initial evidence you gathered — or at least from quantitative to qualitative evidence and from outcomes to the inputs that are linked to those outcomes. For example, suppose that you find a particular school with science performance at the 90th percentile of state performance, more than 50 percent of its student population in traditionally disadvantaged subgroups and no achievement gaps. You have already identified the pattern — an unusual bright spot in science performance — using quantitative data. But what is the cause of the pattern? To understand, you will need to look at (and possibly generate) other evidence, such as through a visit to the school or a phone call to its principal to find out about the school's core practices in science education. This evidence will, in turn, help you to validate, reject or reshape your hypothesis, possibly leading to additional inquiry.

EXERCISE 7: Identify Performance Patterns and Root Causes of Science Performance

Objective(s) for participants:

- Agree on a prioritized list of patterns that characterize science performance in the state.
- Agree on root causes for these patterns and/or on plans to investigate them further.

Instructions:

- Find or prepare one or more sets of analyses comparing historical data from the measures agreed to in Step 1. These may include bar graphs, scatterplots, motion charts or other visual representations of the state's past and present performance on the identified metrics.
- Individually or in pairs, review the data and identify one key performance pattern in the data. Record that on the flipchart template.
- For each performance pattern, record the data to support that pattern, a potential root cause of that pattern and how to investigate that root cause.
- Discuss the identified patterns and root causes in the full group.

Materials needed:

- Data sets
- Flipcharts
- Markers

Exercise notes:

- Performance patterns should be quantitative outcome measures. Examples include:
  - Trends over time (e.g., steady growth or steady decline);
  - Dips or spikes in particular years; and
  - Comparisons (e.g., growth in one subgroup/district but decline in another).
- Root causes should be more qualitative and take into account the inputs that may have led to the performance pattern. Examples include:
  - A new professional development program provided to teachers that caused improved instruction and therefore improved student results;
  - Changes in curriculum or instructional practice;
  - Changes in state policies (rules, regulations, etc.); and
  - A focus on certain districts or certain subgroups.
- Root causes for now are just hypotheses about what may have caused the performance pattern. In the final column, identify how you would investigate those hypotheses further.

Template for Exercise 7

Performance Pattern	Supporting Data	Potential Root Cause	Plan for Investigating the Root Cause

Step 3: Identify Implications for Adoption and Implementation

The eventual objective of all of this work is to derive real and actionable implications for the adoption and implementation plans you are developing for the NGSS. Do any of your negative patterns of performance lend themselves to the case you are building for adoption? Which root causes of performance will you need to attack aggressively, and what kinds of strategies might be best for that? For positive patterns of performance, which strengths can you point to as evidence of momentum for NGSS adoption? Which can be built on, replicated and/or scaled up as part of your implementation plan? There is no one-size-fits-all strategy for every state that is trying to adopt and implement the NGSS, but this step is necessary to make that distinction truly meaningful.

For example, you might find very encouraging data on Advanced Placement passage rates in science but note that participation is uneven across different subgroups of students. If an investigation reveals that one of the root causes of the participation gap is the lack of advanced course availability, then your strategies for implementation will need to focus on access to advanced courses. Or perhaps you find different course requirements by district. Moreover, the equity imperative — the unacceptability of unequal access to world-class science education in your state — will become an important part of the case you make for adoption.

EXERCISE 8: Use Performance Patterns and Root Causes To Identify Implications for NGSS Adoption and/or Implementation Planning

Objective(s) for participants:

- Develop a prioritized list of implications of performance patterns and root causes for NGSS *adoption* planning.
- Develop a prioritized list of implications of performance patterns and root causes for NGSS *implementation* planning.

Instructions:

- Look at the performance patterns and root causes identified in Exercise 7. For each pattern and its root causes, discuss:
  - What strengths can we point to as evidence of momentum for NGSS adoption?
  - What strengths can be built on, replicated and/or scaled up as part of our NGSS implementation plan?
  - Which challenges will become an important part of our case for NGSS adoption?
  - What kinds of strategies will be required to address the major challenges we have identified in the data?
- Discuss and agree on implications and record on the flipchart template.

Materials needed:

- Flipchart template prepopulated with performance patterns and root causes
- Markers

Template for Exercise 8

Pattern or Root Cause	Implications for Adoption Plan	Implications for Implementation Plan

Conclusion

With a clear understanding of the performance patterns in your state and their root causes, you will be positioned to develop your state's role in implementation and the strategies you will use to reach your state goals. That is the subject of the next chapter of this workbook.

Chapter 4: Determine the State's Role and Approach to Implementation

Questions from Diagnostic Tool

- Is there a designated strategic leadership team responsible for selecting the strategies — a coordinated set of activities designed to achieve our goals in science — and for ensuring delivery?
- Is there clear ownership of each of the policy elements related to the NGSS?
- Is there a clear understanding of the political landscape and levers of influence as they relate to *adoption?*
- Have we identified what districts need for *adoption,* what their highest priorities are and what assistance they most need from the state?
- Have we identified what the state's role in NGSS *implementation* will be and how it may need to be different from the current state role?
- Have we specified strategies for the state's role in NGSS *implementation* that are based on evidence?
- Are we confident that the strategies for the state's role in NGSS *implementation* will facilitate the shifts required by the standards in every classroom?
- To what extent are the strategies for the state's role in NGSS *implementation* coherent with CCSS implementation, teacher/leader effectiveness work and other significant initiatives?
- Have we defined *feedback loops* — evidence that identifies whether implementation is on track — that we can use to monitor the likelihood that this plan will deliver its promised results?

As we have noted in previous chapters, the NGSS present an opportunity to improve student achievement and strengthen the relationship between education and economic development. The NGSS are intended to reflect a new vision for American science education, and as such, they demand significant changes in practice from your classrooms to school districts to state agencies.

In the United States, nearly every state practices **local control** — defined broadly for the purposes of this workbook as the strong authority that individual local education agencies have to set and shape what happens in their classrooms. However, the practice of local control does not preclude a state from playing a strong leadership role in implementation efforts. In fact, as the driver of adoption, the state education agency must take responsibility for ensuring that the NGSS deliver on the aspirations they have set for students. At the same time, a "strong" state role does not dictate implementation by mandatory top-down actions. Rather, the challenge for states is to drive real changes in classroom practice in a way that is consistent and compatible with local control.

The magnitude of this shift means that state agencies will need to play a meaningful role in the implementation of the NGSS. The traditional state role — often limited to authority over adoption of standards — will likely be insufficient for two reasons. First, adoption of the standards will not change classroom practice by itself; for that, educators will need a range of supports, including access to NGSS-aligned curricular and instructional materials, support from educator preparation programs, and aligned in-service professional learning.

How this unfolds will inevitably look different across states with different authority, capacity and tradition. For example, when it comes to curricular and instructional materials, in some cases, the state will directly provide materials or processes for required district use. In other cases, the state may provide a list of approved options or highlight exemplars for districts to choose from, and in still other cases, the state may develop materials or processes for voluntary use by districts. Importantly, in each

of these scenarios, local districts and schools would have access to high-quality and aligned curricular and instructional materials. Likewise, when it comes to building educator capacity, the state education agency can take direct responsibility — from professional development around creating and accessing aligned materials to managing the instructional changes required in the classroom — or the state can work with others, including districts, regional service centers, higher education institutions and more traditional vendors, to ensure that the right kinds of supports are in place.

Second, adoption and implementation are complementary conversations. To make the case for adoption, states will need to show that they have a credible plan for implementation — one in which they hold themselves accountable for improved student achievement. This also signals more broadly that the state is thinking comprehensively and long term about implementation. Specific exercises to plan for adoption (including individual state processes, rules, etc.) were explored in Chapter 1.

Whatever your particular situation, the action steps in this chapter will help you define your state's role and the core elements of a preliminary implementation plan. Where possible, the steps lay out principles rather than specific prescriptions, with options for states to choose from based on local context.

Action Steps

Step 1: Define your state's role.
Step 2: Identify core implementation strategies.
Step 3: Draw the delivery chain and identify feedback loops.

Step 1: Define Your State's Role

To identify the ideal role for your state, begin by understanding what kind of role the state has historically played vis-à-vis local education agencies. What has local control looked like in your state? What does your state constitution or statutes actually allow the state education agency to do? In what areas has your state played the strongest or most proactive role?

To analyze this question, consider the typical "levers" that a state uses — and under what circumstances — to influence what happens in schools and classrooms:

Policy/guidance: Creating requirements or imposing mandates. Strategies to apply this lever could include mandating adopting textbooks statewide, revising course-taking or graduation requirements, creating criteria for the kinds of professional development/materials that schools and districts must use, and/or generating lists of approved materials and/or vendors.

Funding: Aligning existing funding streams, incentives and grant programs (e.g., Title II, Part B funds for Math and Science Partnerships) to the desired change in behavior. This could also include the way professional development vendors are funded/managed.[6]

Capacity-building: Providing "optional" or "recommended" resources and/or support of any kind. This could include directing and/or contracting the development and dissemination of aligned curricular materials and professional development, providing guidance on local planning (similar to what is in this workbook), and creating communities of practice for cross-district and cross-school learning. The state

[6] For more information on how state and districts might think about setting budgets and an overview of major federal education programs, see page 3.16 of the Achieve-U.S. Education Delivery Institute CCSS implementation workbook: www.achieve.org/files/Organize_The_Basics.pdf.

has a particularly important role to play in identifying and publicly elevating examples of local practices and/or innovations for NGSS implementation.

Monitoring: Incorporating any of the expectations for what is happening in the classroom into the existing accountability system (e.g., statewide performance goals, determinations, public reporting and incentives), school improvement planning or other monitoring mechanisms. This could be as accessible and transparent as building key indicators into the state and school report cards, or it could simply inform how the state creates and shares data from feedback loops with districts and schools.

Coordination: Eliminating silos and tying the NGSS work to other major initiatives. This might include leveraging existing delivery systems within the state to get the right message and strive toward policy and implementation coherence.

Which of these levers has your state relied on historically? Which has it avoided? In particular, which levers have been relevant in prior adoption and implementation of new standards, such as the CCSS? What additional levers might you access for implementation of the NGSS, and what kinds of changes will this require? These questions are at the core of defining your state's role, and they are covered in more detail in Exercise 9.

The state should always serve as a catalyst for action by providing data and influencing and incentivizing other actors in the system, both in the public sphere and the private sector. However, the state is not necessarily responsible for directly providing resources, professional development, etc. to districts and schools but rather for ensuring that districts and schools have access to resources to meet their local needs.

You may, for example, see that in previous standards implementation efforts, your state generated lists of aligned materials and/or vendors that schools and districts might use (using the capacity-building lever). However, districts and schools were in the middle of materials adoption cycles, so they were not able to put these resources to use given their timelines. Moving forward, you might decide that the state's role needs to include an analysis of what districts and schools need and to what extent — and where — they would welcome state help. This analysis would improve the chances of successful implementation and help build local advocates. Articulating this new role is important for the development of strategies in the next step, but it is also an important part of your case for adoption of the NGSS.

Explaining the role that the state will play — and why — is an important part of building credibility to implement and preparing stakeholders for the changes ahead.

EXERCISE 9: Define Your State's Role

Objective(s) for participants:

- Identify what districts need for adoption, what their highest priorities are and what assistance they most need from the state.
- Understand the role that the state has historically played in standards implementation in the past.
- Articulate the role for the state to play in supporting districts in NGSS implementation.
- Identify the real and perceived barriers or challenges within the state education agency to supporting standards implementation.

Instructions:

- Using the template, answer questions for each of the five levers under "Current Use" columns for the CCSS and past science standards implementation efforts:
  - How has this lever been relied on historically for standards implementation? If it has been avoided, why?
  - What has it looked like when this lever has been used successfully? What made it successful?
  - What has it looked like when this lever has been used unsuccessfully?
- Using the template, answer questions for each of the five levers under "Future Use: NGSS Implementation":
  - How important will this lever be to our implementation of the NGSS?
  - What will we do that will be similar to our current use of this lever?
  - What will be different, and what will that require?

Materials needed:

- Template
- Markers

Template for Exercise 9

Lever	Current Use: CCSS Implementation	Current Use: State-Specific Science Standards	Future Use: NGSS Implementation
Policy/guidance			
Funding			
Capacity-building			
Monitoring			
Coordination			

Step 2: Identify Core Implementation Strategies

The state role you have defined in Step 1 is effectively your theory of action; it specifies how you expect to make a difference in students' science education experience and improve science education and performance. If your state has an overall strategic plan, this should also be reflected. It also sets you up to define the **strategies** that your state will undertake as part of its NGSS preliminary implementation plan.

What is a strategy? For these purposes, a strategy is a coordinated set of activities that are designed to help you achieve one or more of your goals in science education. A strategy should have a beginning and an end, and it should be designed to change something about the way your state does business in science education. Some strategies involve creating something new, while others involve changing or scaling up an existing practice. For example, you may have a higher education strategy that involves working with education school faculty to integrate the NGSS into educator preparation preservice training; this is designed to change current practice, and it will "end" when NGSS-aligned instruction is a standard part of every educator preparation program in your state.

The strategies you select should not be created in isolation from other concurrent initiatives, such as CCSS implementation and teacher/leader effectiveness work — nor should they ignore structures that the state may have already created for these efforts, such as school-district leadership teams or regional centers that serve as a state's primary professional development provider. Rather, in developing your NGSS strategies, your state should make every effort to learn from this work, build on its successes and avoid previous missteps.

Finally, different strategies make different use of the levers defined previously. Some strategies inherently rely on certain levers more than others, but there is often a great deal of flexibility. You may mandate a curriculum, for example (policy/guidance); you may create it and recommend it (capacity-building); or you may give schools and districts monetary incentives to adopt it (funding).

Figure 7 gives some typical examples of strategies for a state to employ in standards implementation. *It is by no means an exhaustive list;* additional areas (e.g., assessment, the role of technology in supporting science instruction) are worth considering in the longer term.

FIGURE 7: Potential State Strategies and Specific Activities[7]

Strategy	Potential State Activities for Each Strategy, by Lever				
	Policy/Guidance	**Funding**	**Capacity-Building**	**Monitoring**	**Coordination**
Curricular and instructional materials	Develop lists of "must-haves" that districts and regional education centers can look at when determining NGSS alignment with their materials. Evaluate existing textbook adoption cycles for all content areas and related policies to ensure alignment with the state's NGSS adoption and implementation timelines.	Encourage appropriate repurposing of state and federal funding streams for aligned curricular and instructional materials where possible, providing samples for districts and schools.	Provide model materials or books that the state has determined are aligned. Elevate and highlight the work of leading districts or schools (e.g., around reuse and refurbishment of science lab materials). Engage educators directly or provide tools and/or resources for districts to engage educators in development, identification and/or piloting of aligned materials. Develop and make widely available tools (e.g., criteria or rubrics) that administrators and educators can use to	Have a system in place to track administrator and teacher access to and use of high-quality, aligned materials and to address problems based on feedback.	Collaborate with other states that are implementing the NGSS. Coordinate with membership associations and third-party organizations' curation and creation of materials aligned to the NGSS. Coordinate districts' and regional education centers' sharing of materials aligned to the NGSS. Coordinate the reuse and refurbishment of science lab materials among districts. Identify informal learning environments that include a wide range of contexts and settings, such as museums, zoos, nature

[7] Education First Consulting and Achieve have partnered on the development of the "Common Core State Standards Implementation Rubric and Self-Assessment Tool": www.achieve.org/common-core-state-standards-implementation-rubric-and-self-assessment-tool.

Strategy	Potential State Activities for Each Strategy, by Lever				
	Policy/Guidance	Funding	Capacity-Building	Monitoring	Coordination
			evaluate the alignment of classroom materials.		and environmental programs, and other science-rich cultural institutions.
Professional development	Require, provide or certify aligned teacher professional development. Develop lists of "must-haves" that districts can look at when formally vetting professional development providers. Identify a clear set of expectations for providers, including evaluating the effectiveness of professional development offerings and assessing their impact. Certify vendors that complete a state professional development training. Create new professional development offerings.	Require that all providers participate in an orientation session. Develop a plan for sustaining a consistent focus on professional development for teachers around the NGSS. Provide resources — funding (reallocating existing funding; providing new, targeted funding; or a combination of the two) and time — to support state/regional/local provision of aligned professional development only. Issue guidance on the repurposing of federal and state dollars to best support implementation	Provide a list of approved professional development providers that the state has determined are of high quality. Require or provide opportunities for teachers and teacher teams to practice applying the NGSS to instructional tasks (e.g., selection of instructional materials, lesson planning, grading student work). Elevate and highlight the work of leading districts or schools.	Develop and collect a standardized evaluation form from all professional development providers. Create a report card for professional development providers. Have a system in place to target support, track progress of professional development efforts, and hold the state and others accountable for continuous improvement based on feedback.	Intentionally coordinate professional development activities across divisions/ departments within the state education agency. Intentionally coordinate professional development activities across regional education centers.

Strategy	Potential State Activities for Each Strategy, by Lever				
	Policy/Guidance	Funding	Capacity-Building	Monitoring	Coordination
		of the NGSS.			
Educator preparation and licensure	Align individual teacher licensure/certification/ endorsement standards to the NGSS.			Publicly report on the effectiveness of teacher preparation programs, including measures that link student growth on NGSS-aligned assessments to program graduates as one factor in determining program effectiveness.	Embed the NGSS in teacher preparation programs. Create a plan to align accreditation standards for institutions/programs/ alternative providers to the NGSS. Create partnerships with or requirements for teacher preparation institutions/programs/ alternative providers to align coursework and other requirements to NGSS expectations for student learning.
Educator evaluation and effectiveness	Align teacher observation rubrics and model teaching standards that clearly articulate the knowledge and skills with which teachers must become proficient to deliver instruction aligned to the NGSS.		Provide training on the use of teacher observation rubrics and other aligned classroom materials to principals/ assistant principals that is focused on the instructional shifts in the NGSS, not just the procedures required to	Create a mechanism to address gaps between teacher evaluation results and access to NGSS-aligned professional development. Create a system to target support, track	

Strategy	Potential State Activities for Each Strategy, by Lever				
	Policy/Guidance	Funding	Capacity-Building	Monitoring	Coordination
	Use guidelines, processes and materials to reinforce alignment to the NGSS through evaluation. Ensure that reports that teachers receive on their performance clearly indicate how well the teachers' students are performing against the NGSS.		implement revamped evaluation systems.	progress of principal professional development efforts focused on instructional leadership for the NGSS, and hold the state and others accountable for continuous improvement based on feedback.	
Graduation requirements	Align minimum high school science graduation course requirements so that they cover all of the NGSS high school standards indicated for all students. Provide guidance to districts and schools to review the courses students are required to take to make sure they are covering all of the NGSS. Develop processes, protocols, guidance and/or exemplars				Ensure NGSS-aligned minimum high school science graduation course requirements seamlessly connect to the course admissions requirements at state colleges and universities.

Strategy	Potential State Activities for Each Strategy, by Lever				
	Policy/Guidance	Funding	Capacity-Building	Monitoring	Coordination
	showing strong alignment among the NGSS and career and technical education expectations and pathways.				
Accountability and data reporting	Set statewide performance goals tied to the NGSS and other college- and career-ready expectations. Create a plan that includes a process for identifying statutory or regulatory changes to be considered or made in light of the transitions under way. Clearly differentiate schools and districts based on status and growth metrics aligned to the NGSS and other college- and career-ready indicators. Align supports and interventions to the intensity and type suggested by school or		Elevate and highlight the work of leading districts or schools that have closed achievement gaps. Facilitate conversations among districts about the types of leading indicators they are monitoring and the best ways to do so. Ensure that educators can access and use data indicators that predict student performance and diagnose specific needs on the NGSS.	Ensure that the state report card for districts and schools clearly shows progress on NGSS-aligned assessments and other college and career readiness indicators.	

Strategy	Potential State Activities for Each Strategy, by Lever				
	Policy/Guidance	Funding	Capacity-Building	Monitoring	Coordination
	district capacity to implement the NGSS.				
Alignment to higher education	Create a strategy for raising awareness among faculty to build support for NGSS adoption.				Create a collaborative working team to align the higher education system and university or college first-year courses with the NGSS. Create a strategy to train postsecondary faculty in the scope, sequence and content of the standards.
STEM agenda	Establish a course approval process to foster innovation in STEM high school course design. Incentivize districts to increase the number and percentage of high school graduates who enroll in college with the intent of majoring in a STEM discipline or who begin careers in fields that require STEM knowledge and skills.	Identify funding streams focused on advancing STEM strategy at the state, regional or district levels.			Define how the NGSS fit into broader state STEM strategies. Encourage local and regional partnerships between K–12, higher education, business leaders and informal science education providers, including museums, zoos, nature and environmental programs, and other science-rich cultural institutions.

With so many options to choose from, how should state leaders go about prioritizing the strategies that are most important to them? There are two main criteria to consider:

Impact: What is the potential for the strategy to improve student achievement (as measured by one or more of your student outcome goals determined in Chapter 2)? In particular, how does it help you to build on the strengths and address the challenges that you defined in Chapter 3?

Difficulty: Given your state's current capacity, how challenging will implementing this strategy be? Can the strategy be designed to rely on the levers that you have defined in your state's role?

Answering these questions will require that you take a moment to define and shape the strategies you are considering. Exercise 10 uses a series of questions to help you to brainstorm and define potential strategies. Exercise 11 will then help you to prioritize them according to the above criteria.

EXERCISE 10: Brainstorm and Define Potential Strategies

Objective(s) for participants:

- Develop a list of potential strategies for NGSS implementation.
- Agree on a brief description of what each strategy would entail.

Instructions:

- Using the potential strategies and specific activities list in Figure 7 as a starting point, brainstorm a list of potential strategies and fill them in on the template.
- For each strategy, fill in the template:
  - Rationale: How does this strategy contribute to one or more of the state's student outcome goals? (See state aspiration from Chapter 2.)
  - Definition of success: If this strategy were successful, what would success look like in three years' time?
  - Scale: What is the intended scale of implementation? How many teachers/students will be affected?
  - Levers: Which levers does this strategy make the most use of and how?

Materials needed:

- Flipchart template
- Markers
- Copies of Figure 7 for each participant

Exercise notes:

- You may need to narrow down the initial list of strategies before filling in the template.

Template for Exercise 10

Strategy	Rationale	Indicators of Success	Scale	Levers

EXERCISE 11: Prioritize Potential Strategies According to Impact and Difficulty

Objective(s) for participants:

- Identify priority strategies based on their potential impact and degree of difficulty.

Instructions:

- Using the list of strategies identified in Exercise 10, place each strategy on the 2 x 2 matrix template on the flipchart, according to its individual impact and degree of difficulty.
- Once you have placed each key strategy on the matrix, reflect on the overall picture. Specifically, consider the following questions:
  - Are strategies accurately placed in relation to one another?
  - Should certain strategies be priorities based on their potential for impact and their degree of difficulty?
  - Can certain strategies be deprioritized based on their potential for impact and their degree of difficulty?

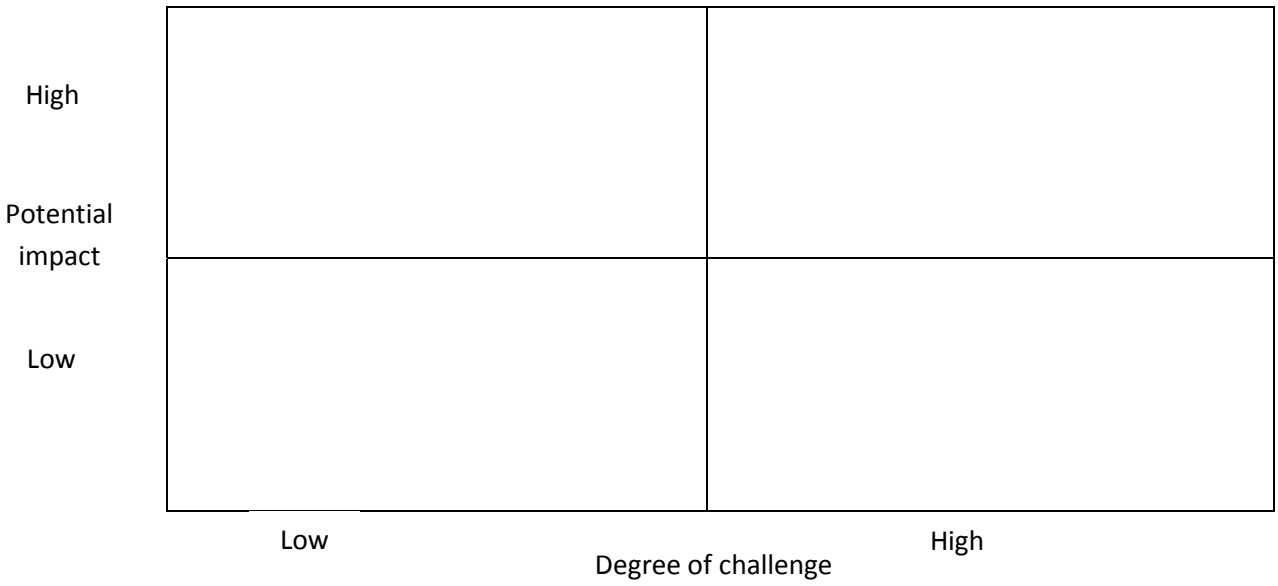
Materials needed:

- List of strategies from Exercise 10
- Flipchart
- Markers

Exercise notes:

- Encourage participants to really reflect on impact and difficulty and avoid classifying all strategies as high impact and high difficulty.
- Use the full spectrum provided by the matrix to indicate which strategies are higher or lower than others.
- Urge participants to avoid placing strategies "on the line" and to make a judgment as to whether those strategies are slightly more on the high or low side.

Template for Exercise 11



Step 3: Draw the Delivery Chain and Identify Feedback Loops

A prioritized set of strategies is an important first step toward a good preliminary NGSS implementation plan. Drawing your **delivery chain** will take these strategies to the next level.

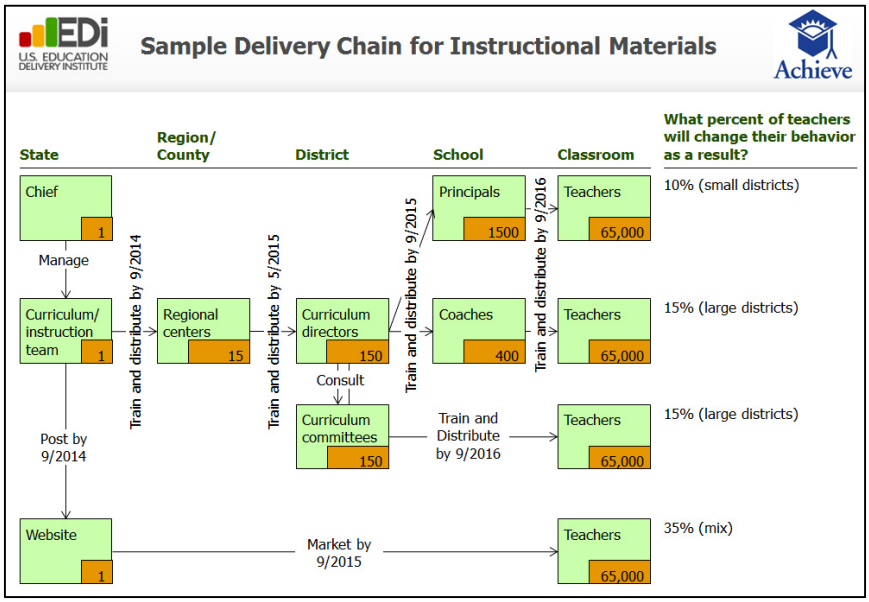
A delivery chain answers the question: "How, and through whom, will our NGSS strategies reach the field at scale?" Starting with your leadership at the state level and ending with a change in science instruction for thousands or millions of students, how will it happen? To do this, a delivery chain defines four things:

- The **actors** — people or organizations — who have a role in implementing strategy at every level, (e.g., state, district, school, classroom) and the number of personnel affected at each (e.g., 10,000 teachers, 1,000 principals, 100 superintendents);
- The **role** that each actor plays in implementing the strategy;
- The **relationships** that this implies between each of the actors; and
- The **most direct line** of influence between the beginning and the end of the chain.

You may choose to create a delivery chain for each of the strategies you have prioritized, or you may choose a subset of them. In many cases, several strategies will "share" the same delivery chain. Bear in mind that you may already have such a structure in place for other initiatives you are undertaking, such as CCSS implementation and teacher/leader effectiveness work. Where it makes sense, you should try to integrate the different delivery chains across these strategies.

An example of a delivery chain for a single strategy — aligned curriculum and instructional materials — is given in Figure 8. The beginning of the chain is the state chief and the curriculum and instruction team for science, and the end of the chain is the state's 65,000 teachers (split out by their presence in small and large districts). The dissemination of instructional materials mainly takes place through "traditional" channels at the regional, district and school levels: The curriculum and instruction team trains and distributes materials to 15 regional centers, which in turn work with the curriculum directors at 150 districts. Then, depending on the size of the district, the curriculum directors pass the materials on to principals, school-based coaches or district-based curriculum committees, who then work with teachers. In a completely separate channel, the materials are posted on the state's website, which is accessed by a certain number of teachers.

FIGURE 8: Sample Delivery Chain for Instructional Materials



A delivery chain serves three primary purposes:

- Details a given strategy, including those involved and their relationships;
- Allows you to test for potential weaknesses and adjust your strategy to address them; and
- Creates feedback loops that allow you to monitor the quality and fidelity of the strategy's implementation.

The first purpose can be seen from Figure 8: It allows you to flesh out the development of a given strategy. A delivery chain is, in effect, a more detailed plan about what you expect to happen. Beyond the vague label of "curriculum and instructional materials," you now know a lot more about the assumptions underlying this strategy: A set of materials will be created. It will be disseminated on an optional/recommended basis to teachers through five key role groups. You also have assumptions that are critical to test: Is it plausible for 35 percent of all teachers to access the website? Does our curriculum and instruction team have the capacity to train the staff at 15 regional centers? Can each regional center take on an average of 10 districts apiece? If we are successful, will we reach the field at sufficient scale to make a difference? In a very real sense, drawing your delivery chain puts real meat on the bones of a strategy.

EXERCISE 12: Draw a Delivery Chain for One or More Strategies

Objective(s) for participants:

- Identify the key actors in the delivery chain.
- Map the relationships between each key actor to create the delivery chain.

Instructions:

- For an identified strategy, identify where it begins and ends as well as the levels in between.
- At each level, identify the other key people or organizations that could be involved in implementing the strategy.
- For each identified actor, record how many there are.
- Draw the most important line of direct influence from the beginning to the end of the chain and describe the relationships between each actor.
- Draw any secondary lines or relationships involved and describe those relationships.
- Repeat as needed with additional strategies.

Materials needed:

- Flipchart
- Markers

Exercise notes:

- Typically the delivery chain will loosely follow from the state to region to district to school to classroom.
- Encourage participants to get specific about the actors that fall under those key categories, articulating organization names or specific names or titles of individuals.
- Encourage participants not just to map the actors but also to consider how many of each actor there are and what the relationships are between each.
- Delivery chains will be messy, but the discussion is part of the benefit.

The second purpose of a delivery chain is related to the first: It allows you to test for potential weaknesses and adjust your strategy to address them, whether by changing the delivery chain itself or strengthening the links within it. There are at least four types of weaknesses to look out for in a delivery chain:

Individual relationships: What is the quality of personal relationships among the key actors in the delivery chain? Where are the areas of strongest and weakest leverage?

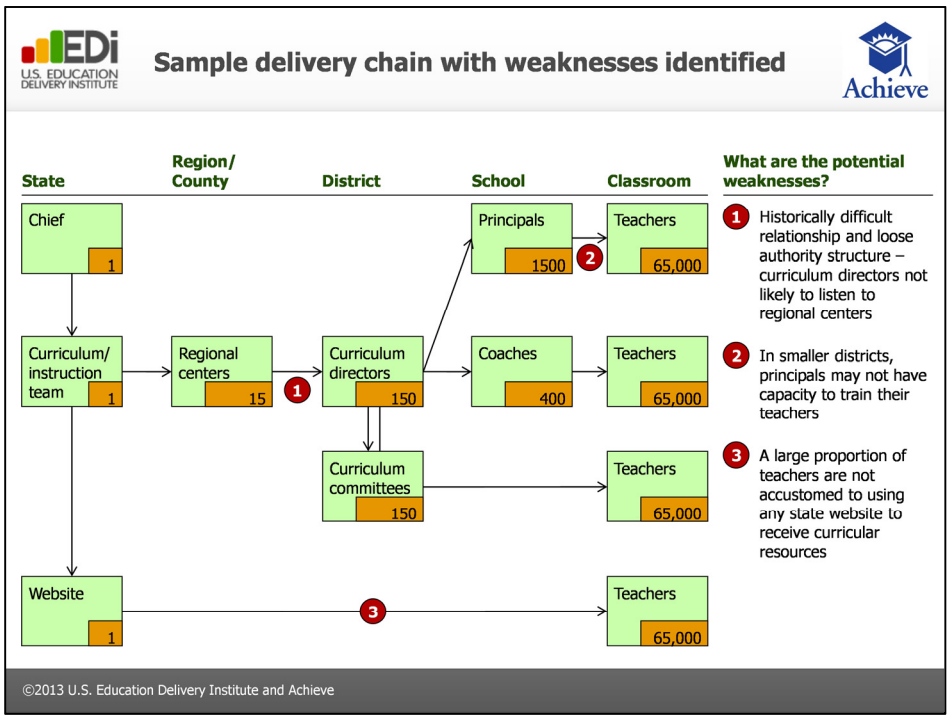
Complexity: How many actors are involved in the delivery chain? How easy or difficult is it to coordinate those actors to get something done? Is the chain unnecessarily complex?

Funding flows: What are the major sources of funding and resources? Who controls these flows, and in which direction(s) do they go? Are they aligned to the flows of influence envisioned in the delivery chain or not?

Choke points: Are there particular actors that you disproportionately depend on to get something done?

Figure 9 gives an example of how you can examine a delivery chain and pinpoint the weaknesses on it.

FIGURE 9: Sample Delivery Chain with Weaknesses Identified



EXERCISE 13: Identify and Address Potential Weaknesses in Your Delivery Chain

Objective(s) for participants:

- Identify weaknesses in the delivery chain.
- Identify potential solutions to the identified weaknesses.

Instructions:

- Using the delivery chain created in Exercise 12, consider potential weaknesses.
- Particularly identify potentially challenging relationships, overly complex parts of the chain, areas where there may be a mismatch between funding flows and the delivery chain, and potential choke points in the delivery chain.
- Record these weaknesses on the flipchart template.
- For each of the weaknesses, identify potential solutions and record those on the flipchart template.
- Repeat as needed with additional strategies and their associated delivery chains.

Materials needed:

- Delivery chain from Exercise 12
- Flipchart
- Markers

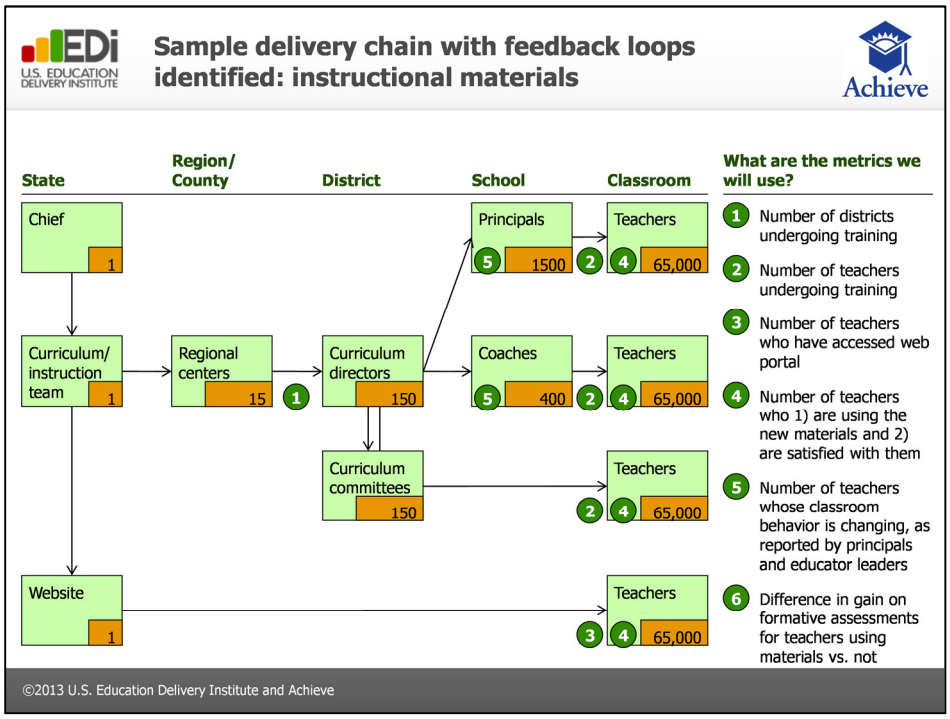
Template for Exercise 13

	Potential Weaknesses	Potential Solutions
Individual relationships		
Complexity		
Funding flows		
Choke points		
Other		

The final purpose of a delivery chain is to create **feedback loops** that allow you to monitor the quality and fidelity of a strategy's implementation. A feedback loop is a type of evidence that you commit to collecting to know whether your strategy is on track to deliver its promised results or whether challenges exist that require more attention. Evidence from feedback loops is particularly important for mid-course corrections in implementation, as the data on student outcome goals are normally not available more than once a year. Examples of feedback loops include surveys of educators/school leaders, focus groups or interviews with educators/school leaders, participation in events, evaluations of resources or materials, informal observations, formal audits, or website hits.

A delivery chain is helpful for creating feedback loops because it allows you to "read" particular areas where you will want to know more about the quality of implementation. For example, you may choose to develop feedback loops to assess the quality of implementation in the areas that are most critical or most at risk. Figure 10 gives an example of how feedback loops can be read from a delivery chain.

FIGURE 10: Sample Delivery Chain with Feedback Loops Identified



How do you prioritize which feedback loops to develop? Start by looking at the delivery chain and prioritizing the particular actors (state education agency staff, regional center staff, district coaches, principals, teachers, etc.) that you will want to focus on. Which ones are the most critical and/or the most challenging? Then, for each role group, consider what questions you want to answer about how implementation is playing out for them. In the context of your NGSS strategies, you can ask at least six types of questions:

Inputs: What did they experience? For example, did training take place as planned? Did they receive the messages we intended them to receive?

Reaction: Was the training a productive use of time? For example, how well were the trainings and/or materials received?

Learning: Did they learn what they were expected to do? For example, do teachers now understand the conceptual shifts required of them by the NGSS? Do regional center staff understand what kind of training they are responsible for delivering?

Support: Were they set up for success? For example, have the support and evaluation systems for teachers shifted to align with NGSS expectations?

Fidelity of implementation: Are they changing their practices to meet the new expectations? For example, is NGSS-aligned instruction happening in classrooms? Are principals holding teachers accountable for that instruction?

Outcomes: Is student achievement increasing, and are achievement gaps closing?

Once you have prioritized your questions, you can develop specific sources of evidence to answer each of them. You can consider several different types of sources, including:

- Surveys of people in role groups across the delivery chain. This includes pre- and post-training surveys and more general surveys.
- Interviews and focus groups of representative people in role groups across the delivery chain. You may have a standing group of people in each role group that you return to regularly for feedback from the front lines.
- Site visits to schools and/or districts to see how implementation is playing out on the ground. The number of visits you can make is limited, but they can serve as a useful "spot check" on implementation.
- Analysis of educator and/or student artifacts, such as lesson plans, teacher evaluation summaries, student work, materials from trainings, etc. Again, these can be examined on a "spot check" basis to get a sense for what is happening.
- Formative and summative assessment data, sometimes as a source in and of themselves and sometimes to crosstab with other types of evidence.

In prioritizing your sources of evidence, it will be important to start with information that you already have and add new data collection only if absolutely necessary. Many states have in place some form of each of the above sources of evidence; the goal may be to adjust these rather than creating additional work.

EXERCISE 14: Define Feedback Loops for Your Strategies

Objective(s) for participants:

- Identify key questions to be answered for your strategies.
- Identify sources of evidence to use to answer those questions.

Instructions:

- Using the full set of delivery chains you created, consider how you will know the strategies are successful.
- For each of the six types of feedback loops, identify key questions to answer about the strategies, keeping the important role groups from your delivery chain in mind. Record those on the flipchart template.
- For each of those questions, identify the evidence and sources to answer them and record those on the flipchart template.

Exercise notes:

- This exercise needs only be done once — not for every delivery chain.
- The exercise can also be done by keeping the priority strategies in mind, even if you have not drawn delivery chains.
- Identifying key questions for each of the six feedback loop types is not necessary, but you should encourage participants to think through how to gather the evidence for each key question they have identified.

Template for Exercise 14

Type of Feedback Loops	Key Questions	Sources of Evidence To Answer Them
Inputs		
Reaction		
Learning		
Support		
Fidelity of implementation		
Student outcomes		
Other		

Conclusion

In these first four chapters, you have explored the most critical elements of adoption and preliminary implementation planning, which include a preliminary implementation plan with well-defined core strategies that are based on a shared aspiration and an honest look at current performance against that aspiration. The next chapter, on setting targets and trajectories, establishes the mechanism for connecting all of these things together into a coherent plan for NGSS adoption and implementation.

Chapter 5: Set Targets and Trajectories

Questions from Diagnostic Tool

- Do the appropriate leaders have access to the data needed to determine past and present performance? How easy or difficult is pulling historical or real-time data? Is there a culture of using data to shape state goals and track progress against them?
- Have we estimated the impact that each of our strategies will have on these goals over time?
- Do we have confidence that the strategies will be sufficient to help us achieve our goals?

In previous chapters, you developed an aspiration related to the NGSS and identified strategies you expected would help you achieve that aspiration. This chapter will help you establish specific targets for each of the goals under that aspiration and estimate the impact that each of your strategies will have on those targets. In short, it will help you connect your planned actions to expected outcomes. Being able to share this with stakeholders during the adoption and planning phases will help show that your state has a clear picture of where you are trying to go and a clear expectation for how the NGSS will improve student performance.

Before you get started, it will help to understand how key terms are defined for the purposes of this chapter. Keep in mind that the terms you use in your own state may vary based on previous context and use. Key terms in this chapter include:

Goal: As noted in Chapter 2, a goal is a more specific piece of your overall aspiration. For example, your aspiration may be that all students are college and career ready, but your goal may be improving the number of students taking more rigorous science courses in high school.

Metric: Your metric is the quantitative measure you will use to determine progress on your goal (you came up with some of these in Exercise 6 in Chapter 3). For example, in the goal of improving the number of students taking a series of at least three science courses that reflect the full set of content and performance expectations of the NGSS standards, the metric is the number of students taking three lab science courses.

Target: A target is the specific level of your metric that your state intends to reach by a given point in time. For example, if your metric is the percentage of students taking three lab science courses, your target might be that 65 percent of all students meet this benchmark in 2015. This target should be based on past performance (see Chapter 3) and other evidence of what is possible.

Trajectory: A trajectory is a projection of a metric's path over time from its current level to the level suggested by the target. It is your best estimate of the how your system will perform at each point in time en route to achieving its overall target. For example, if your target is 65 percent of all students taking three lab science courses in 2015 and the baseline indicates that 56 percent of students met this target in 2012, your trajectory would map the targets for the years in between. How you get those estimates is the subject of the remainder of this chapter.

Why is translating the goals in your aspiration to metrics, targets and trajectories important? In particular, why make year-to-year estimates of progress that are likely to be wrong? As noted above, a trajectory estimates the expected impact of your strategies on your student outcome goals. As such, it proposes a direct relationship between the actions you take and outcomes (results for students) — one that can be tested by the data that come in over time. The important thing is not that you get the trajectory exactly right but that you compare it with the actual data to understand why you over- or

underperformed. A trajectory, then, is a tool for monitoring progress that you can use to hold yourself accountable for the expected impact of your work.

Action Steps
Step 1: Establish a performance target. **Step 2:** Connect your strategies to expected outcomes. **Step 3:** Create more detailed trajectories to monitor implementation progress.

Step 1: Establish a Performance Target

The first step is to establish a metric and performance target for each of your high-priority student outcome goals — that is, to decide how you will measure progress and at what level your state should perform by a certain point in time.

Use the data you explored in Chapter 3 to inform your target, and keep in mind that targets should be SMART:

Specific: A target must leave nobody guessing as to its meaning and implications for the expected change.

Measurable: A concrete and agreed-upon standard should be established for measuring progress.

Ambitious: A good target should feel like a stretch from the current level of performance and inspire your system to rise to a new challenge.

Realistic: A target should be grounded concretely in the internal and external affecting factors — otherwise a target is little more than a guess.

Time limited: Your target should have a defined deadline, both to create a sense of urgency and allow for accountability.

Establishing a target that is both ambitious and realistic can be challenging, but it is vitally important. If the target is not ambitious enough, it will not do enough to inspire and drive improvements in your state. But if the target is not realistic, it will not be seen as achievable and will also not drive improvements. To find the balance between ambitious and feasible, look at benchmarking across other states and nations and within your own state. There are four types of benchmarking to consider:

Historical performance: How have levels of the target metric moved in the past? To what extent should you expect your state or its subgroups to outperform history?

Districts within state: Within your state, how does performance differ across districts? What does the performance of some districts suggest about what others (particularly those with similar characteristics) should be able to attain?

Against other states: How does your state's performance compare, both now and historically, to that of other states? How do students, teachers or districts in your state compare to their peers with similar characteristics in other states?

International: How does your state's performance compare with the performance of systems in other countries, both now and historically? How do students, teachers and districts in your state compare to their peers with similar characteristics in systems around the world?

Based on your own state's past performance and the performance of others, establish your target.

For example, when you examine high school students' course-taking patterns, you may find that students, on average, take biology and chemistry in high school (per the state's existing graduation course requirements), but you want to move toward a goal of all students taking courses that reflect the full set of content and performance expectations of the NGSS standards and at least three science courses. An analysis of course-taking patterns is more than just the number or names of required courses; more important are the content and rigor of those courses and their alignment to the state standards. To complete this comprehensive review, your state will need to identify the levers you will use to ensure that courses taught in high schools throughout the state are consistently rigorous and aligned with the state standards. Otherwise, the content or instruction in these courses, particularly in the more advanced ones, may become watered down as more students enroll in them.

Looking across the districts in your state, you may find variations in course-taking patterns despite the state course-taking minimums: Students in most middle- and high-income districts in your state may be taking at least three science courses, but students in low-income schools may be taking the state minimum. This discrepancy could be a result of a number of factors, including students' access to courses as well as the tendency of higher-income districts to require students to exceed the state minimum course requirements. You also may find that while some students currently are exposed to content-rich and stimulating classes that build college- and career-ready skills in high school, many others have access to courses that are rigorous in name alone. Your state decides to dig a bit deeper into the middle- and high-income districts and finds disparities in the science course-taking patterns of specific subgroups of students. You determine that improving science course-taking in the lowest-income districts to match the rates in middle-income districts and closing the course-taking gaps between subgroups within high-income districts would have a large impact on your overall state target.

Lastly, include a date or deadline for accomplishing that target. By setting a time limit, you will create a sense of urgency around the work.

EXERCISE 15: Determine a Metric and Target for Each Goal

Objective(s) for participants:

- Identify how to measure success for the established goals.
- Use benchmarking data to establish a target for each goal.

Instructions:

- For each goal established earlier, identify the key metric that will be used to measure success. Record each goal/metric on the flipchart.
- Explore benchmarking data, including historical, district-to-district, state-to-state and international comparisons, for each goal/metric set. Record findings on the flipchart.
- Using the benchmarking data, decide on a potential target for each goal/metric and record it on the flipchart.
- For each target, set a date when it should be reached and record the date on the flipchart.
- Discuss the targets. Particularly consider:
  - Do the targets meet the SMART characteristics — particularly, are they ambitious and realistic?
  - Are the targets tied to the benchmarks?
  - Do they make sense given what we know about historical performance of our state as a whole, our individual districts, and other states and nations?

Materials needed:

- List of identified goals
- Flipchart
- Markers
- Benchmarking data

Exercise notes:

- Deeper data analysis will likely need to be done ahead of time to prepare for the discussion about how certain changes to state and district performance would affect the overall outcome.
- Encourage participants to establish targets that strike the delicate balance between ambitious and realistic.

Template for Exercise 15

Goal	Metric	Benchmarking Findings	Target	Target Date

Step 2: Connect Your Strategies to Expected Outcomes

Next, consider each of the strategies you identified in Chapter 4. Each strategy was connected to one or more of your goals (and the associated targets) in Exercise 15. What do you expect that the impact of each will be over time on these goals? You will want to feel confident that the strategies you identified will help your state reach its established target and that these strategies are emphasized (and funded) according to their expected impact.

EXERCISE 16: Evaluate the Expected Impact of Strategies on Established Goals

Objective(s) for participants:

- Determine the order of expected impact of strategies from highest to lowest.

Instructions:

- For one goal, gather the list of priority strategies you identified in Chapter 4.
- Taking the full list into account, record the strategy expected to have the highest impact on the goal at the top of the flipchart.
- Record the strategy expected to have the least impact on the goal on the bottom of the flipchart.
- Continue evaluating each of the strategies and recording them on the flipchart where they fall along the spectrum from high to low impact.
- Reflect on and discuss the ordered list:
  - Based on their expected impacts, are the identified strategies enough to help us reach our target? If not, do we need to adjust the strategies so they affect more students? Or do we need to add more strategies?
  - Do funding priorities align with expected impact? That is, are those strategies that are expected to have the highest impact those that are most heavily funded or resourced? If not, does this need to change?

Materials needed:

- List of priority strategies
- Flipchart
- Markers

Exercise notes:

- When considering potential impact, consider the number of students affected by the strategy and the degree to which the metric will be affected.
- Complete this exercise for the key strategies for one goal first. Repeat with additional goals if it is useful.

Template for Exercise 16

	Strategies
Highest impact	
Other	
Lowest impact	

This prioritization will give you an initial estimate of the impact of each of your strategies on your goal or goals. This estimate can be used to determine strategic and funding priorities as you make the case for adoption. Step 3 takes this estimate to the next level so that it can be used in implementation planning and monitoring.

Step 3: Create More Detailed Trajectories To Monitor Implementation Progress

A more detailed trajectory makes use of past and present performance (Chapter 3) and the estimated impact of your strategies (Chapter 4) to map expected future performance over time.

Begin by establishing a baseline. The baseline helps you determine, given the trends you have seen in past data, the path of the metric in the coming years if you did nothing at all. Understanding the baseline will help you begin to map your expected path, taking into account the strategies you identified. To map the baseline, focus on the trends of your metric over time and consider where you would expect performance to move in the next few years without the focus on implementation. Specifically, consider:

- Has past progress been linear?
- If there were peaks and dips, what caused them?
- Do you expect peaks or dips in the future due to other major events?

States may naturally gravitate toward assessment results as an outcome, but caution should be taken before choosing to use an existing state assessment as an indicator, as severe limitations exist on what these data will be able to tell you. For example, using assessment data benchmarked to previous versions of state standards — or using old state assessments to set trajectories on new standards and new assessments — cannot capture the conceptual shifts of the NGSS and may create mixed messaging and communications challenges. Data will not be able to provide insight or serve as a proxy for evidence of NGSS implementation successes or areas of challenges. Districts and schools working to implement the NGSS will also likely be contending with being held accountable for existing standards and state assessments. They also may be phasing in new teacher and leader effectiveness systems. Be sure to consider the more creative inputs and outcomes your state discussed in Chapter 3. Figure 11 illustrates an example of an estimated baseline.

FIGURE 11: Estimated Baseline

Metric	2009	2010	2011	2012	2013	2014	2015	2016
Percentage of students taking three lab science courses	55%	55%	56%	59%	59%	60%	65%	70%
Potential events						New graduation course requirements begin for entering freshmen: 3 lab sciences		

EXERCISE 17: Establish a Baseline for Performance

Objective(s) for participants:

- Understand the expected baseline for performance.

Instructions:

- Using one of the metrics identified in Exercise 15, plot the historical data over the past several years on the flipchart.
- Consider any potential future events that may affect performance and make note of those in their associated years on the flipchart.
- Taking into account the historical performance trend and the future events, estimate performance for the next several years, assuming the strategies identified in the previous chapter are not implemented.
- In a few sentences, describe the rationale behind this baseline. That is, why do we expect performance to be the way we have mapped?

Materials needed:

- Flipchart
- Markers
- Historical data

Exercise notes:

- Remind participants that this is intended to be an estimate, using the data available — this is not a perfect science.
- Keep in mind that for the purposes of this exercise, you are plotting performance without the strategies you identified previously. In the next exercise, you will begin to take those strategies into account.

Template for Exercise 17

Metric	Historic	Historic	Historic	Current	Future	Future	Future	Future
Potential events								
Rationale								

Once you have established your baseline, consider the impact of your strategies along the way to help you reach your intended target. In Step 1 you established a target, and in Step 2 you ordered your strategies according to their expected impact. Now you will take that one step further and estimate the number or percentage of students affected each year (or other time period) by a given strategy.

Start by identifying whether each strategy will have a high, medium or low impact on the target metric each year. Use your timeline from Chapter 1 to estimate when each level of impact will occur for each strategy. For example, consider whether proposed professional development for teachers will yield a high impact on student proficiency immediately or whether this impact will be seen a few years down the road, once teachers have been able to truly adjust their practice to better align with the standards. Exercise 18 will help you consider the expected impact of each strategy each year.

EXERCISE 18: Classify Your Strategies as Having a High, Medium or Low Impact Over Time

Objective(s) for participants:

- Identify the potential impact of the identified strategies.

Instructions:

- Using the ordered list of strategies created in Exercise 16, identify whether each will have high, medium or low impact on the target metric in the next year.
- Repeat this for the next several years, keeping in mind that the impact of a given strategy will likely change over time.

Materials needed:

- Flipchart
- Markers
- List of strategies in order of expected impact

Exercise notes:

- Remind participants that this is intended to be an estimate, using the data and evidence available — this is not a perfect science.
- Push participants to be really thoughtful about which strategies will be high impact and when. Keep in mind that some strategies will show impact nearly immediately, while others will take a few years to show their true impact.

Template for Exercise 18

Strategy	Year 1	Year 2	Year 3	Year 4

Next, put numbers on your judgments of high, medium and low. For each level, associate it with an approximate number or percentage point of additional students who will be affected. Keep in mind the number of students in the group receiving the strategy to make these estimates realistic. You might use the distance between your baseline and your target as a benchmark. For example, if you have to gain 15 points in five years, you would want to average three points per year. So one to two points would be low impact, three points would be medium impact and four to five points would be high impact. While we know progress typically does not follow a straight line, you can set your "medium" at the straight line level and use it to put numbers for each strategy in each year.

Based on those numbers, you can add up each of the strategies to project the overall number of additional students affected each year. This summation will provide annual targets that should lead you to the end target, and your team will be able to monitor progress on these each year. The estimates of high, medium and low that you made in the last exercise will help you create the shape of your trajectory.

EXERCISE 19: Use the Projected Impacts of Strategies To Map Your Trajectory

Objective(s) for participants:

- Understand the expected baseline for performance.

Instructions:

- Decide on the preferred method for associating numbers with the high, medium and low impacts described earlier.
- Using the results from Exercise 18, change the high, medium and low judgments into percentage points or numbers and record those on a new flipchart template.
- Add up the expected impact of all of the strategies for each year and record the total impact by year on the flipchart.
- As in Step 2, reflect on whether these estimates make sense, given the context in the state. In particular, consider the following and adjust the estimates as necessary:
  - Does the trajectory have implications for the strategies we identified? Are resources appropriately allocated to high-impact strategies? Do the strategy impacts add up to our target?
  - Does our target seem ambitious and feasible given the strategies we expect to affect it?
  - Have we taken into account changes in assessments, changes in the number of students assessed, or other major events that may cause dips or otherwise unusual changes in the data we are measuring?

Materials needed:

- Flipchart
- Markers
- High, medium and low ratings from Exercise 18

Exercise notes:

- Remind participants that this is intended to be an estimate, using the data available — this is not a perfect science.
- It may be useful to convert proficiency rates (percentages) into the actual number of proficient students and consider impact in terms of number of students rather than percentages.

Template for Exercise 19

Strategy	Year 1	Year 2	Year 3	Year 4
Baseline				
Total				

Based on your answers to these questions, adjust the trajectory as necessary to ensure that it is a useful tool that is reflective of the expected impact of your work.

Conclusion

You have now created targets and trajectories for each of your key goals. The final two chapters of this workbook will help you to communicate about and monitor this plan. Specifically, the next chapter will outline strategies for engaging stakeholders and getting buy-in and support for your plan, while the chapter after that will help you establish routines for regularly monitoring progress on your trajectories and problem-solving when off course.

Chapter 6: Develop a Stakeholder Engagement Strategy

Questions from Diagnostic Tool

- Have we created core messages for our adoption and implementation plan?
- Have we identified the stakeholders whose support we will need? Do our messages speak to them?
- Do we have a plan for engaging stakeholders, including champions in the field and the public at large?
- Have we identified our key opponents and their points of opposition, and do we have a strategy for addressing the challenges they may pose?

The success of NGSS adoption and implementation will depend not just on its substance but also on the support of critical stakeholders. In Chapter 1, you identified the strategic leadership team — those tasked with creating an overall vision for the NGSS and the timeline, phase-in strategy and work plan for both adoption and implementation. In this chapter, you will explore what it means to widen the circle to include additional supporters. However, stakeholder engagement is only one piece of a larger communications plan, which your state will need to create. If your state is trying to establish a new communications plan or strengthen an existing one, additional resources are available through Achieve's Future Ready Project.[8]

A common mistake is to think of stakeholder engagement as an add-on to an adoption and implementation plan. Too often, states create communications plans without sufficient attention to stakeholder engagement. In truth, not communicating enough is one of the biggest risk factors for any major change effort, particularly one as high profile as NGSS adoption and implementation. Communicating and engaging with key stakeholders is important as you gear up for NGSS adoption and implementation. The work will inevitably be difficult, and you may suffer setbacks. In those moments, you will want to know that you can count on your key stakeholders to support your work so you can continue to move forward. For this reason, think of stakeholder engagement as a process that requires planning at the same level of rigor as the policy and practice changes covered in prior chapters. Many of the principles are the same, even if the tools are different. This chapter provides advice and exercises on how to use these tools to maximum effect.

Action Steps

Step 1: Develop key three messages.
Step 2: Identify and analyze the stakeholders who are most critical to successful adoption and implementation.
Step 3: Build your guiding coalition.
Step 4: Establish a process and plan to handle potential challenges.
Step 5: Develop a stakeholder outreach strategy.

Step 1: Develop Key Three Messages

The key messages are at the heart of your stakeholder engagement plan. They aim to take your state's overall adoption and implementation plan and translate it into terms that make sense for others. Ideally, you should be able to boil down what you want to communicate to three central messages — the "key three." Typically, the first message will define the issue, the second will outline the problem and the

[8] See www.futurereadyproject.org/communications-planning.

third will explain the solution. The key three are most effective if they are developed and owned by a large group of stakeholders; used by all relevant leaders and advocates; and communicated consistently, without variation, at all times.

The discipline of repetition should be carried across all communications channels. And while you will develop submessages for each target audience or around common criticisms of the NGSS, those submessages will fit under the key three, and overarching key three messages should be communicated at all times by all leaders/members in all media.

The first step in developing the key three messages for the NGSS begins with your state's aspiration (see Chapter 2) as the starting point. Specifically, key messages can answer any of the following questions:

- What are we trying to accomplish for our students and the United States in science education and why?
- How will we know that we have done it? What are our specific goals/targets?
- What is holding us back from reaching our goals/targets?
- Why and how are the NGSS essential to our success? How are they different from what we already do? How will they help us overcome the challenges we face?
- What are the benefits to students, our economy and the workforce by having college- and career-ready graduates in not only English language arts/literacy and math but also science?

While these topics may not be appropriate to address in the top-level messages, it is important to have ready messages and responses to address these questions as well:

- What strategies are we undertaking to implement the NGSS?
- What are the biggest changes these strategies will require in our districts, schools and classrooms?

As you can see, you will find the answers to these questions in the work that you have done in the first five chapters of this workbook. The key is to distill this thinking down into a few bullet points that can anchor your effort.

FIGURE 12: Sample Key Three NGSS Messages

Following are two sets of sample key three messages:

Sample 1:

- Science education in the United States has gone stagnant; more than a third of 8th graders score below basic on science assessments, and fewer students choose to pursue science-based careers every year.
- It has been 15 years since K–12 science standards were revised. Since then, there have been many advances in the fields of science and technology, science education, and the innovation-driven economy, yet our science standards — and science education — have not kept pace.
- The NGSS — developed by educators, scientists and experts in science education — will, by design, engage students at the earliest grades through graduation so that all students become informed citizens who are knowledgeable about how science and technology affect everyday life.

Sample 2:

- The United States has a leaky K–12 STEM talent pipeline, with too few students entering STEM majors and careers at every level — from those requiring relevant postsecondary certificates to those requiring Ph.D.s — which puts the United States' position as a global leader in innovation at

risk.

- We cannot successfully prepare students for college and careers — and keep the United States competitive — unless we set the right expectations and goals. While standards alone are no silver bullet, they provide the necessary foundation upon which the rest of the science (and STEM) education system can be built.
- Implementing the new NGSS will help ensure that all students graduate with critical skills in specific science disciplines as well as problem-solving, inquiry and reasoning — preparing them for the rigors of science-based college courses and STEM careers and securing their future and the future of our country.

EXERCISE 20: Develop Key Three Messages

Objective(s) for participants:

- Identify the key questions that need to be answered.
- Create key three messages to answer the identified key questions.

Instructions:

- Using the list of key questions, identify those that are most important to the communications effort or those that should be emphasized to key stakeholders and circle them on the flipchart.
- As a group, draft answers to each of the questions and record those as core messages on the flipchart.
- Reflect on the list of core messages.
  - Are they complete?
  - Are they concise?
  - Do they provide the information stakeholders most need?
- Adjust the core messages as necessary to fit those characteristics.

Materials needed:

- Flipchart
- Markers

Template for Exercise 20

Key Questions (circle the ones to emphasize)	**Key Messages**
What are we trying to accomplish for our students and the United States in science education and why?	
How will we know that we have done it? What are our specific goals/targets?	
What is holding us back from reaching our goals/targets?	
Why and how are the NGSS essential to our success? How are they different from what we already do? How will they help us overcome the challenges we face?	
Secondary Questions	Supporting Messages
What strategies are we undertaking to implement the NGSS?	
What are the biggest changes these strategies will require in our districts, schools and classrooms?	

Step 2: Identify and Analyze the Stakeholders Who Are Most Critical to Successful Adoption and Implementation

Once you have decided on your key messages, you are ready to identify the most critical stakeholder groups to serve as audiences for those messages. Beyond your guiding coalition, what stakeholder groups could potentially be most relevant? Some ideas to consider:

- Students;
- Teachers, teachers unions, and state and local chapters of professional associations of science teachers such as the National Science Teachers Association, the National Association of Biology Teachers, the American Association of Physics Teachers and STEM networks in your state;
- Parents and parent associations;
- Guidance counselors;
- School administrators and their professional associations;
- District curriculum staff;
- Regional service centers and education providers;
- State education leaders and staff (including state science standards leadership teams);
- State science supervisor;
- Public and private institutions of higher education, particularly schools of education;
- Informal science education providers;
- Civil rights organizations, philanthropic organizations and other third-party advocacy groups;
- The business community (e.g., chambers of commerce, local STEM industry leaders);
- STEM organizations and networks;
- Workforce development organizations and agencies;
- The scientific community; and
- State leadership teams.

It is also important to identify the decisionmakers from your state who are responsible for adopting the NGSS and allocating funding to support implementation. Such decisionmakers include:

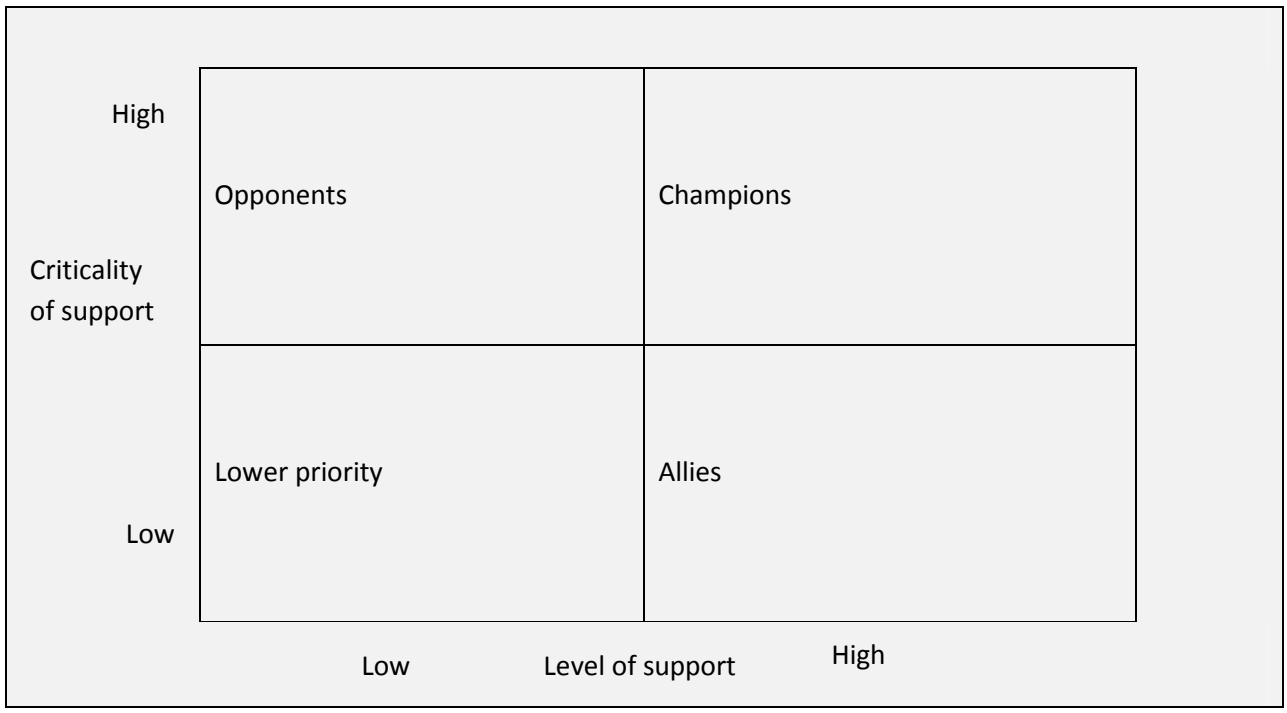
- School board members and associations;
- District superintendents;
- Chief state school officer;
- State board of education members;
- State legislators, particularly chairs of education committees and appropriators; and
- The governor, including education policy advisers.

As you are selecting your key stakeholders or stakeholder groups, try to be as specific as possible — for example, by naming a particular professional association or distinguishing supportive legislators from those who are opposed. The point is to identify all of the individuals and groups you may need to directly engage and then answer two critical questions about each:

- **Criticality of their support:** How important is it that they support your plans for NGSS adoption and implementation? When, where and how will their support be needed?
- **Level of support:** How supportive are they currently?

You can plot the answers to these questions on a 2 x 2 matrix, as shown in Figure 13.

FIGURE 13: Stakeholder Mapping



A stakeholder group's location on this map has implications for your approach to the group. For example, stakeholder groups that are critical to your success and already very supportive are your champions — they are the type of group that you must keep engaged and deploy to engage others. Similarly supportive groups that are less critical to your success are allies — it is nice to have their support, but they need to be engaged with less intensity. Working to develop allies is especially important because they may become champions with enough exposure to the issue. Critical but unsupportive groups are opponents. Most opponents will never be converted into champions; your goal may simply be to minimize their numbers by broadening your base of support and be able to respond to their concerns. Almost always, increasing your pool of champions is more productive than trying to convert opponents.

EXERCISE 21: Identify and Map Your Stakeholders

Objective(s) for participants:

- Identify those stakeholders who are most critical to successful adoption and implementation.
- Determine the current level of support and criticality of support for each stakeholder.

Instructions:

- Brainstorm the stakeholders who will need to be involved at all levels of *adoption* of the NGSS. Be sure to consider those at the state, district, school and classroom levels, as well as external stakeholders. Use the list on page 87 of the workbook as a guide.
- Using the 2 x 2 matrix template, place each of the key stakeholders on the template according to their current level of support and the criticality of their engagement in NGSS *implementation.*
- Reflect on which stakeholder groups fall into which categories (champions, allies, opponents) according to the matrix.
- Repeat the exercise for stakeholders who will need to be involved in the *implementation* of the NGSS.

Materials needed:

- Flipchart
- Markers

Exercise notes:

- Participants should use the full spectrum provided by the matrix to indicate which stakeholders are higher or lower than others.
- Urge participants to avoid placing stakeholders "on the line" and to make a judgment as to whether those stakeholders are slightly more on the high or low side.
- Participants should focus on developing strategies for increasing the group of champions (moving allies to champions) and having a crisis management strategy for dealing with opponents.

Template for Exercise 21

Criticality of support	Low	High
High		
Low		

Level of support

Step 3: Build Your Guiding Coalition

As discussed in Chapter 2, an aspiration is not real unless it is collectively shared. While the overall case for adoption is broader than just the aspiration, grounding your aspiration with the support of a critical mass of stakeholders will be crucial to your ability to make that case.

But building stakeholder support starts with a smaller group of people: the guiding coalition. A guiding coalition is a small group of highly visible and credible leaders who share your aspiration and will sustain your effort to adopt and implement the NGSS in the face of pushback and other challenges. The guiding coalition ought to consist of a subset of influential stakeholders whose collective efforts have the potential to make a significant difference in reaching your aspiration. A guiding coalition is not a steering committee or a formal decisionmaking body, nor is it the same thing as the state's strategic leadership team. Critically important is to determine who is responsible for this coalition once it is built; it is not realistic to think the group will convene itself.

The role of the guiding coalition is to help remove barriers to change, exert influence at key moments to support adoption and implementation, and provide counsel to the strategic leadership team that is responsible for developing the state's strategy. The guiding coalition can serve as a sounding board, and their opinions may help shape the policy recommendations made by the strategic leadership team. Interactions can take place informally and formally, through both individual conversation and/or small-group meetings.

Figure 14 gives some examples of people you might want to include in your guiding coalition. As you can see, "official" leaders figure prominently in the list, but informal influence is just as important.

FIGURE 14: Members of the Guiding Coalition

The composition of a guiding coalition will inevitably vary across states; no single formula will work for everyone. Your state may want to consider the following list of influential stakeholders as potential guiding coalition members:

- Governor's office;
- Legislature (particularly crucial committee chairs, their advisers and permanent staff);
- State board of education members and/or staff;
- Higher education governing board members and/or staff;
- State education agency leadership;
- Workforce development agency leadership;
- Business community leadership (chambers and/or roundtables);
- Philanthropic community leadership;
- The engaged public, including advocacy and other third-party organization leadership, and civil rights organizations; and
- Union and association leadership, including teachers and administrators.

You may choose to involve your guiding coalition at different stages of your adoption and implementation effort. Initially, you may choose to engage members of the guiding coalition for refinement and feedback on your aspiration. (See Chapter 2.) The objective would be to align a powerful group of people around a shared aspiration for NGSS adoption and implementation and to secure their commitment to supporting it.

EXERCISE 22: Build Your Guiding Coalition

Objective(s) for participants:

- Identify the members of the guiding coalition.
- Develop a strategy for engaging and deploying each member to support NGSS adoption and implementation.

Instructions:

- Brainstorm possible members of the guiding coalition, casting the widest net possible.
- Narrow the list by excluding those who would be unlikely to ever support the aspiration.
- Evaluate the list using a criterion of diversity, balance, potential to work together, etc.

Materials needed:

- Flipchart paper
- Markers

Exercise notes:

- Guiding coalitions are typically comprised of seven to 10 key external members.

Template for Exercise 22

Potential Guiding Coalition Member	Current Level of Engagement and Interest in Adoption/ Implementation Effort	Sphere of Influence (Legislature, Teachers, Department of Education, etc.)	Top Two to Three "Asks" for Each	Next Steps

Step 4: Establish a Process and Plan To Handle Potential Challenges

In addition to developing your key messages, you will need to establish a process for handling potential issues that may arise. You may face challenges from opponents of the NGSS and will need a process for addressing these issues efficiently and effectively. In many cases, it makes sense for there to be a clear point person/organization for tracking pushback and coordinating your coalition's response to such challenges — and for this point person/organization to be outside the government. By using a third-party organization or leaders — such as a business organization or advocacy coalition — you can ensure that the defense is protected from changes in leadership and remains independent. In the past, the states that have been able to most successfully sustain reforms as significant as the NGSS have had strong third-party partners supporting communications and advocacy throughout adoption, implementation and beyond. Your process could include the following:

- Creating a crisis management plan that identifies ahead of time potential issues, responses and spokespeople;
- Communicating to the guiding coalition and other champions about the problem;
- Determining the best surrogates — and how you would deploy them effectively;
- Creating a communications strategy for making your point of view known (media contacts, press releases, op-eds, events, surrogates, social media, etc.); and
- Contacting Achieve to strategize.

Having a process and a plan to handle the issues in advance will assist you in ensuring that any issues that arise are handled quickly and will not result in a loss of support.

Step 5: Develop a Stakeholder Outreach Strategy

Stakeholder engagement, while it encompasses all of the work in your plan, must be treated as a strategy in and of itself, worthy of the same planning and monitoring as any other part.

To map out your specific engagement strategy, consider six sets of questions for each priority stakeholder group you identified in the previous step:

Objective: Starting from your stakeholder group's current position, where would you like to move them? Is your objective for them to be supportive when asked? To be "out in front," winning other converts?

Tailored message: How will you refine your key messages from Step 1 to resonate with all of your stakeholders? You may need to consider what the coming changes mean for them and what you need them to do. Tailoring messages does NOT mean having a different message; your key three messages should be the same for everyone. Tailoring messages means adding to the key messages by speaking to the needs and concerns of your audience. For example, elementary school teachers will understandably want to know about the plan for their professional development around the NGSS and how/when new instructional materials will be developed.

Communications channels and activities: What existing or new mechanisms will you use to reach these stakeholders? These mechanisms could include face-to-face meetings, e-mails/newsletters, social media, conferences, paid media, town halls/roundtables, etc.

Timeline for engagement: When and how often will you engage this group in this way? This is the part that puts the "plan" in your outreach plan; for each action you identify, be sure to assign responsibility and a deadline.

Surrogates from this group: Who from this stakeholder group can you call upon to be on the record? Who are your key messengers, and how will you recruit more over time? These are essentially ambassadors you will want to work with to communicate and advocate among their peers on behalf of the NGSS.

Feedback loops: As with your adoption and implementation strategies in Chapter 4, how will you know you have succeeded? What processes do you have in place to collect and respond to both positive and negative feedback about your outreach efforts? Consider some of the tools for evidence collection, particularly surveys and interviews, covered in Chapter 4.

What is most important is that stakeholders are engaged often and that you provide them with the information and support they need to be successful champions and allies. For example, providing professional associations of science teachers with customizable cards with key messages that can then be disseminated to their members will empower members to serve as champions and allies for the NGSS. Engaging business leaders by connecting the NGSS to STEM education and U.S. innovation through roundtable discussions can help ensure that you have respected champions. Exercise 23 will help your team work through these questions and develop your own stakeholder outreach strategy.

EXERCISE 23: Develop a Stakeholder Outreach Strategy

Objective(s) for participants:

- Create an outreach strategy for each priority stakeholder group.

Instructions:

- Using the priority stakeholder groups identified in Exercise 21, answer the following for each and record on the flipchart:
  - What is our objective for this group? That is, taking into account their current level of support, where would we like to move them? What ideal role will they play?
  - What is the tailored message for this group? That is, what from the core messages we identified in Exercise 20 is most important for this group to know and understand?
  - What are the existing or new channels of communication needed to reach them?
  - What is the timeline for engagement with this group? When and how often? Who is responsible, and what are the deadlines?
  - Who are our key messengers or communicators drawn from each stakeholder group? How will we recruit them and ensure that they remain engaged and informed?
  - What will our feedback loops be for this group? That is, how will we know our messages have been successful? What processes do we have in place or will we put in place to collect and respond to feedback?

Materials needed:

- Flipchart
- Markers
- List of priority stakeholders identified in Exercise 21

Template for Exercise 23

Stakeholder Group	Objective	Tailored Message	Channels or Activities	Timeline for Engagement	Surrogates from This Group	Feedback Loops

Conclusion

You should now have the beginnings of a robust stakeholder engagement strategy. The plan contains key messages and messengers to support the adoption of the NGSS. The next chapter on establishing routines and solving problems will assist you in ensuring that your broader stakeholder efforts drive adoption and implementation forward.

Chapter 7: Establish Routines and Solve Problems

Questions from Diagnostic Tool

- Have we established regular performance dialogues to monitor our progress toward achieving our goals and the likelihood that we will achieve them in the future?
- Is there clear ownership of each of the policy elements related to the NGSS?
- Do these routines rely on a broad evidence base, including the feedback loops in the implementation plan, to arrive at a regular and shared view of progress?
- Do these routines help leaders identify and solve the most challenging problems as they arise?
- Do these routines build on established processes and mechanisms for management that are already in place?
- Do we regularly communicate our progress/decisions internally to the state education agency and externally to those interested and/or affected (e.g., districts, state board, key legislators)?

The final thing to consider in planning for NGSS implementation is establishing or refining routines for monitoring progress and solving problems. This work will occur as you transition to implementation of the NGSS.

Routines are regular opportunities for key leaders to discuss progress, identify challenges and develop solutions to drive implementation forward. At their heart, routines are intended to answer questions such as "Are we on track to achieve our promised results? And if not, what are we going to do about it?" They make your implementation planning real. As opportunities to regularly review progress against what is laid out in your plan, routines will make your adoption and implementation plan a true living document that drives your work. Routines may take a number of forms, from in-person meetings to written notes, but should all include a discussion of performance in which the chief or other key system leader holds other leaders accountable for implementation progress and student outcomes.

Routines will allow your strategic leadership team to identify and address challenges early, before they become major stumbling points. Managed well, they will allow state leaders time to focus on the work that is expected to have the greatest impact on student outcomes and avoid getting distracted by the loudest problem of the day. Your state likely has some form of performance management routines in place already. In this case, you should consider how to leverage your existing routines to monitor progress on the implementation of the NGSS. This could mean adding NGSS implementation as a focus at regular intervals for the senior leadership team. It could mean adjusting an existing science-focused routine to include NGSS implementation. Or it could mean integrating the NGSS into routines for CCSS implementation. It will be up to the leadership of the agency to decide how routines for NGSS implementation best fit into the existing structure.

This chapter is broken into two parts. The first will allow you to reflect on existing performance management routines and consider how they can be adapted to allow you to monitor the progress of NGSS implementation. The second part provides more concrete tips and tools for organizing, preparing for and conducting routines.

Action Steps

Step 1: Reflect on existing performance management routines and consider how they can be adapted to monitor the progress of NGSS implementation.
Step 2: Organize, prepare for and conduct routines.

Step 1: Reflect on Existing Performance Management Routines and Consider How They Can Be Adapted To Monitor the Progress of NGSS Implementation

Most state agencies have some sort of routine meetings, but true performance management routines may look different from what is already in place. To engage the full strategic leadership team, it may be necessary to either create new routines or modify existing ones so that all of the relevant stakeholders are able to participate. Strong routines should include each of the following characteristics:

Agreeing on a common purpose: Do all people participating in the routine clearly understand and agree on its purpose — to discuss performance against priorities, identify and solve problems, and identify and commit to clear next steps?

Arriving at a shared view of performance and progress: Is the discussion structured to help participants discuss and agree on current progress against priority goals? What range of evidence is used to support this discussion?

Identifying and solving problems: Does the routine help participants identify and agree on the most critical barriers to achieving priority goals? Does it create space for creative problem-solving that empowers participants to address these challenges?

Encouraging learning and collaboration: Does the routine encourage participants to identify challenges that are common among their peers and learn from each other's best and most promising practices?

Identifying and committing to clear next steps: Does every routine produce a clear and actionable list of next steps for all relevant participants that can be tracked through future routines?

To be clear, the goal is not to add routines for routines' sake but to make sure that the routines that exist include these key characteristics. Exercise 24 will help you reflect on the quality of an existing routine and consider how you can leverage it to monitor progress on NGSS implementation.

EXERCISE 24: Reflect on the Quality of Existing Routines

Objective(s) for participants:

- Evaluate whether existing performance management routines meet the criteria for a strong routine.
- Identify recommendations for strengthening an existing routine.

Instructions:

- Choose an existing performance management routine that could be used to monitor progress on NGSS implementation. This could be an existing routine for science or a related initiative such as implementation of the CCSS.
- For that performance management routine, review each characteristic of a strong routine and record the existing strengths on the flipchart.
- Again referring to the characteristics, record the things that might be missing from the routine.
- Using the identified strengths and challenges of the existing routine, create key recommendations for strengthening the existing routine and integrating NGSS implementation.

Materials needed:

- Flipchart
- Markers

Template for Exercise 24

Existing routine:		
Characteristics/Questions To Consider	**Strengths of Existing Routine**	**Existing Challenges or Things Missing from Existing Routine**
Agreeing on a common purpose: Do all people participating in the routine clearly understand and agree on its purpose — to discuss performance against priorities, identify and solve problems, and identify and commit to clear next steps?		
Arriving at a shared view of performance and progress: Is the discussion structured to help participants discuss and agree on current progress against priority goals? What range of evidence is used to support this discussion?		
Identifying and solving problems: Does the routine help participants identify and agree on the most critical barriers to achieving priority goals? Does it create space for creative problem-solving that empowers participants to address these challenges?		
Encouraging learning and collaboration: Does the routine encourage participants to identify challenges that are common among their peers and learn from each other's best and most promising practices?		
Identifying and committing to clear next steps: Does every routine produce a clear and actionable list of next steps for all relevant participants that can be tracked through future routines?		
Recommendations:		

The recommendations you develop for improving your routine will vary based on what already exists in your state. Step 2 in this chapter is designed to help you put the recommendations you developed in Exercise 24 into practice. Step 2 provides concrete tools and tips for preparing for and conducting routines. Note that these tools are quite specific, so you can choose to use or adapt them as necessary to fit your own state's context.

Step 2: Organize, Prepare for and Conduct Routines (Optional)

There are a number of things to consider when organizing, preparing for and conducting routines. The tools laid out here may be of use to your state team when designing new routines or making substantial refinements to existing ones.

First, consider who is and who should be involved in your routines. At minimum, routines should include:

- A top system leader, likely the chief, who is receiving the report. In some cases, this will be the chief state science supervisor or the governor's education policy adviser. The leader of the routine will vary according to where the responsibility for your goals and strategies lies.
- The person responsible for implementation of the particular target, strategy or district you are reviewing progress for or the person responsible for NGSS implementation more generally.
- The person responsible for organizing the routines and gathering relevant data.
- Other key leaders within your agency or key stakeholders involved in the implementation work, as appropriate.

Finally, you will also want to structure routines so their format and frequency fit the needs of those involved. Routines should occur frequently enough that major challenges will not go unnoticed but not so frequently that preparation becomes an overwhelming burden. When scheduling, consider the existing schedule of routines, use existing meetings when possible and work to ensure coherence with routines around related priorities such as the CCSS.

As you saw in Step 1, it is important for routines to be focused on a clear, common purpose. While the purpose may sometimes seem evident, clearly articulating what your routine will measure can help create this common focus. Note that if you completed the exercises in the previous chapters, much of this has already been determined. The goals you established in Chapter 2, the strategies you identified in Chapter 4, and the associated targets and trajectories that you established in Chapter 5 should form the basis of routines as often as new data are available on those particular metrics. You will likely have routines more often than new data are available, however, so consider what other data you will use to measure progress. It will be up to you to choose the level of detail that is appropriate for your context. You might explore progress on specific strategies or targets or even specific districts that require additional assistance, as they relate to your overall goals.

Note that routines do not always require quantitative data. While the data you use in routines will often be quantitative leading indicators of your larger target metrics, you should also consider what qualitative data you might use to inform progress. The feedback loops you established in Chapter 4 are important qualitative evidence indicating implementation progress.

Exercise 25 will help you identify the data you will use to monitor progress. Again, bear in mind that if you completed the exercises in previous chapters — particularly those related to defining your aspiration and planning implementation — this exercise should mostly be about revisiting that material and filling in any additional blanks.

EXERCISE 25: Define the Data Used for Measuring Progress

Objective(s) for participants:

- Identify the data to use for measuring progress in the NGSS implementation routines.

Instructions:

- For each goal identified previously, answer each of the following questions and record responses on the flipchart:
  - What measure (or measures) will we use to show progress on this goal?
  - How will we know we are successful?
  - How will we collect the necessary information ahead of each routine?
  - Who will be responsible for the success of this goal?

Materials needed:

- Flipchart
- Markers
- Responses from previous exercises, if applicable

Template for Exercise 25

Goal	What Measure(s) Will We Use?	How Will We Know We Are Successful?	How Will We Collect the Information?	Who Will Be Responsible for Success?

With so many data points to collect and review, putting it all together to provide a clear view of progress often can be difficult. To address this difficulty, you may choose to use the assessment framework tool to measure progress. The assessment framework, detailed in Figure 15, allows for (1) the comparison of different kinds of data and (2) the incorporation of a qualitative component of evidence (in the form of calibrated judgments) beyond the data alone. In short, this tool will help you bring together existing qualitative and quantitative evidence to answer the question: Given what we know about progress on relevant activities, what is the likelihood that we will be successful?

FIGURE 15: Assessment Framework

The assessment framework[9] is a qualitative rubric that asks several rigorous questions about the stages of implementation to determine the likelihood of success of a given component. The qualitative judgments are combined with the data that are available to render an overall judgment. The framework can be applied at any level — to a particular goal (what is the likelihood we will reach our target?) or to a strategy within that goal (what is the likelihood the strategy will deliver its estimated contribution to the goal?).

Participants will use the assessment framework rubric with the key available data to render a judgment for three components of the goal or strategy:

- Quality of planning;
- Capacity; and
- Evidence of progress.

Rating	Definition
Green	On track; very high likelihood of success
Yellow	Mixed results; mid to high likelihood of success
Orange	Problematic; low to mid likelihood of success
Red	Highly problematic; very low likelihood of success

Each component should be given a rating on a scale of green to red: Participants should then combine the three components and examine the overall picture to come to an overall judgment regarding likelihood of success for that goal or strategy. This judgment should follow the same green to red scale.

Finally, participants should calibrate the results by sharing and comparing their findings. They should reflect deliberately about whether a green judgment looks the same within and across goals and strategies and adjust findings as necessary to ensure valid, shared results. These data enable the strategic leadership team to have regular conversations about whether the implementation activities are having the expected impact. By applying a similar type of routine and assessment framework to each of the components of the goal or strategy, the strategic leadership team can establish a monitoring system to help drive results. Ultimately, the purpose is to identify implementation barriers and problem solve.

[9] The assessment rubric is a deliverology term used by the U.S. Education Delivery Institute; it is not to be confused with a state education agency's assessment system and blueprint.

Assessment Framework Rubric			
Element of Framework	**Key Questions**	**Ratings**	
		Very Low Likelihood (Red)	Very High Likelihood (Green)
Quality of planning	Have we identified a key person and team responsible for leading the strategy or goal and ensuring success? Does our strategy or goal have a plan (possibly as part of a larger plan) that sets out clear milestones for implementation and measures of progress, with an estimate of how (and how much) the work will affect the target(s)?	We have no clear accountability for this strategy or goal. We have no plan, or we have a plan that falls short in several ways: • Includes no milestones or measures; • Does not reflect current reality of work; and • Makes no connections to the target(s).	We have a clear plan that makes a plausible case for how this work will affect our target(s). The plan's milestones and measures provide a clear basis for monitoring and accountability. The plan has a leader and team that uses it to drive ongoing work and monitor progress.
Capacity	Have we specified the roles that everyone will need to play — at the state, district, school and classroom levels — for implementation to have a real impact on the target(s)? How well are we engaging with these people to build capacity? How willing and able are they to play their roles right now?	We do not have a clear sense of who will need to do what for the strategy to be successful. We do not have a clear sense of what it will take to reach our schools and classrooms at scale. Our engagement with schools and classrooms is sporadic and based on the hope that we will somehow reach a critical mass of people.	We have identified the specific individuals at every level who are critical to the strategy's success and the role each will have to play to implement the strategy at scale. Most of these critical individuals are aligned with the work and have sufficient capacity.
Evidence of progress	What evidence do we have that shows whether implementation is working as intended to have an impact on the target(s)? What do the latest data say about our progress on this strategy or goal? What do the latest data say about our progress on the target(s) itself?	We do not consistently monitor progress on this strategy or goal. We do not use evidence of progress, or our evidence is limited to the data on the target. To the extent that we have any kind of evidence, the data are stagnant or moving in the wrong direction.	We collect and review relevant evidence as soon as it is available, ranging from outcome metrics to leading indicators and process measures. Feedback loops result in mid-course corrections. Process and leading indicator data are improving.

Figure 16 illustrates the assessment framework in use. Exercise 26 will allow you the opportunity to practice using the assessment framework with a goal or strategy you have identified as critical to your NGSS implementation.

FIGURE 16. Sample Assessment Framework

Goal:	**Increasing course-taking and passage rates for rigorous science courses at the high school level**	
	Rating	Rationale
Quality of planning		We have identified the strategies we expect to help us achieve this goal and responsible leaders for each. But more could be done to articulate specific milestones for those strategies so we can more clearly monitor progress.
Capacity		We understand who is doing what at the state level and have begun to think about how we'll interact with schools and teachers, but we have not yet begun to connect with the field and therefore do not have a clear idea of capacity and challenges at that level.
Evidence of progress		Because we are still in the early stages of implementation, we have little evidence at this point. We are working to establish milestones to monitor our progress. We are also working to create a pipeline with districts so we can have up-to-date data on course-taking and grades from schools.
Overall likelihood of success		While we are still in the early stages, we have a clear idea of where we want to go with this work, and we know what we need to do to make it happen. The challenges that lie ahead involve finding the time and capacity to implement our strategies and provide support to districts and schools, as they are the key players in this work.

EXERCISE 26: Use the Assessment Framework To Make a Judgment on the Likelihood of Success for a Given Strategy or Goal

Objective(s) for participants:

- Evaluate current likelihood of success for a strategy or goal.
- Identify the challenges, next steps and help needed to improve the likelihood of success.

Instructions:

- Select a goal or strategy identified in a previous exercise to evaluate; record it on the flipchart.
- For that goal, answer the following, using the assessment framework rubric, on the flipchart:
  - What is the quality of planning on a green to red scale? Why?
  - What is the capacity on a green to red scale? Why?
  - What is the evidence of progress on a green to red scale? Why?
- Taking into account the judgments made for quality of planning, capacity and evidence, plus any additional data that may be available, make a green to red judgment on overall likelihood of success for the goal or strategy. Record it, as well as the rationale, on the flipchart.
- Using the notes in the rationale sections of the template, compile the potential challenges for successful implementation of this goal or strategy and record them on the flipchart.
- Based on those challenges, decide on next steps and identify any areas where additional help or resources are needed. Record them on the flipchart.

Materials needed:

- Flipchart
- Markers
- Assessment framework rubric
- Responses from previous exercises, if applicable

Exercise notes:

- It may be helpful to have individuals use the rubric on their own and then share answers in the group to come to consensus.
- You could also ask individuals or small teams to each evaluate separate goals or strategies and then come together and calibrate color judgments across goals or strategies.

Template for Exercise 26

Goal or Strategy		
	Rating	Rationale
Quality of Planning		
Capacity		
Evidence of Progress		

Overall Likelihood of Success		

Potential Challenges	
Potential Next Steps	
Potential Help Needed	

To ensure that routines are able to meet the key characteristics — particularly arriving at a shared view of performance and progress — a good bit of preparation is required. You may want to identify a person responsible for preparing for and running routines to ensure that they happen. This implementation coordinator will not be the chief or the person directly responsible for implementation and outcomes. Instead, this person will be responsible for gathering evidence on progress, using that evidence to prepare an initial view of progress, setting agendas and preparing for discussions, and briefing the chief and the person responsible for implementation ahead of time. This person is responsible for ensuring that routines happen and that they are structured and managed effectively to achieve the necessary outcomes.

The implementation coordinator should gather the evidence identified in Exercise 25, use it to make a judgment on the progress so far and then develop the agenda. Generally, agendas will follow the same objectives, based on the key characteristics of a strong routine:

- Arrive at a shared view of progress;
- Identify specific challenges and the root causes behind those challenges;
- Identify strategies for getting back on track; and
- Identify and commit to next steps and discuss areas of need or assistance.

The implementation coordinator should be deliberate in shaping an agenda, developing the necessary materials and briefing the key participants ahead of time so that the routine is set up to meet those objectives. This includes structuring activities — such as discussions, presentations, Q&A, brainstorming, and problem-solving — so they meet the intended objectives. He or she can also prepare guiding questions to help drive the conversation and ensure that participants arrive at a shared view of progress and next steps. Figure 17 includes examples of some typical guiding questions that might be useful for this purpose. Finally, the implementation coordinator should identify the necessary data and prepare or gather the necessary analyses to use in the routine.

FIGURE 17: Guiding Questions To Drive Conversation

Type of Guiding Question	Examples
Hold others to their own standards	"How do you know that what you're focusing on will improve student performance in science?" "Your commitment to narrowing gaps is inspiring; how do you intend to address the special education student gap?"
Test assertions	"You mentioned that you thought your leadership team was strong. How do you know that?"
Follow premises to the logical conclusion	"If you have a goal, why wouldn't you have a plan that shows how you intend to deliver on that goal?" "If you are trying to focus on performance, wouldn't it be important to collect this information?"

Type of Guiding Question	Examples
Use comparisons to provide challenge and to take excuses off the table	1: "I don't see how 75 percent proficiency is possible, given our level of disadvantage." 2: "Well, the school down the road is getting 90 percent, and it has the same level of disadvantage as you — so what's stopping you?"
Encourage prioritization and focus on root causes	"What are the top three barriers that you face to making this work?" "What are the top three messages that you'd want to send to the chief?" "Where is the biggest issue and why?"
Put participants in the shoes of the front-line or end user	"If you had a group of your students here right now, what would they say are the reasons they do not take upper-level science courses?" "That's a really great articulation of the issue. If I spoke to teachers in these schools, would they give a similar message?"
Use "what-if" questions to test the possibilities	"How much would we improve if we got the bottom quartile to perform at the level of the current average?" "How much would we improve if every teacher in every classroom got just one more student to score proficient this year?"
Use comparisons to find solutions	"Are there other schools that have the same issue as you but aren't struggling in the same way? What do they do about it?"
Suspend disbelief	"What would it take to get 20 more students to take upper-level science courses at a given school next year? If there were no constraints, what would it take?"

Exercise 27 will help the implementation coordinator take the outputs out of the previous exercise to prepare an agenda for a routine focused on that goal, including key objectives, necessary data and guiding questions.

EXERCISE 27: Develop an Agenda for a Routine

Objective(s) for participants:

- Create an agenda, including key data and questions, to meet the objectives of a strong routine.

Instructions:

- Using the goal or strategy evaluated in Exercise 25, identify any additional objectives for this routine and record them on the flipchart.
- For each objective, answer the following and record responses on the flipchart:
  - How will I ensure that the objective is met in the meeting? That is, how will I structure that time to meet that objective? What balance of presentation, data exploration, questioning, discussion and problem-solving will I use?
  - How long will this portion take?
  - What materials will I need to prepare or bring to move the conversation forward and help participants reach the intended objective?
  - What key facts or data will I bring?
  - What key questions will help move the discussion forward?

Materials needed:

- Flipchart
- Markers

Exercise notes:

- While this agenda might seem quite detailed (perhaps even overly detailed), deliberately considering each of these elements ahead of time will help prepare a more effective conversation, ensure that each part of the agenda is addressed and result in an all-around better routine. You may choose to adapt the agenda for your needs, but keep these elements in mind.

Template for Exercise 27

Goal or Strategy To Be Reviewed	

Objectives	Arrive at a shared view of overall progress
	Identify and commit to next steps

What (Objective)	How	Time	Materials	Key Facts	Key Questions
Arrive at a shared view of overall progress					
Identify and commit to next steps					

Conclusion

In this chapter, you connected the work done in previous chapters to real implementation. The routines discussed here will help turn your adoption and implementation plans into reality by making them usable documents that drive the work.

Glossary of NGSS Workbook Terms

Aspiration — A powerful tool that signifies a shared understanding of what success looks like. It must be clear, measurable and understandable to everyone. In the case of the NGSS, the aspiration will describe the impact your state expects the new content standards and related assessments to have on student learning. *See Chapter 2.*

Assessment Framework — The assessment framework is a qualitative rubric that asks several rigorous questions about the stages of implementation to determine the likelihood of success of a given component. The qualitative judgments are combined with the data that are available to render an overall judgment. The framework can be applied at any level — to a particular goal or to a strategy within that goal. *See Chapter 7.*

Element — The workbook is organized around seven elements of NGSS adoption and implementation planning: designating a strategic leadership team and reviewing your capacity for adoption and implementation of the NGSS; defining your aspiration for what the NGSS will accomplish in your state; evaluating past and present performance in science education in your state; determining the state's role and approach to implementation of the NGSS; setting targets and trajectories for future student achievement in science; developing a stakeholder engagement strategy for maintaining consistent support for NGSS implementation; and establishing routines for monitoring progress and solving problems. *See Introduction.*

Guiding Coalition — A small group of highly visible and credible leaders who share your aspiration and will sustain your effort to adopt and implement the NGSS in the face of pushback and other challenges. The role of the guiding coalition is to help remove barriers to change, exert influence at key moments to support adoption and implementation, and provide counsel to the strategic leadership team that is responsible for developing the state's strategy. The guiding coalition ought to consist of a subset of influential stakeholders whose collective efforts have the potential to make a significant difference in reaching your aspiration. Guiding coalitions are typically comprised of seven to 10 key external members. *See Chapter 6.*

Key Three Messages — You should be able to boil down what you want to communicate to three central messages — the "key three." Typically, the first message will define the issue, the second will outline the problem and the third will explain the solution. The key three are most effective if they are developed and owned by a large group of stakeholders; used by all relevant leaders and advocates; and communicated consistently, without variation, at all times. *See Chapter 6.*

Metric — A metric is the quantitative measure you will use to determine progress on your goal. *See Chapter 3.*

Strategic Leadership Team — A team tasked with creating an overall vision for the NGSS and the timeline, phase-in strategy and work plan for both adoption and implementation. The strategic leadership team should include representatives who are knowledgeable about your state's current science standards, have the capacity to consider and make recommendations about each of the elements that should be in the adoption and implementation plan, and ultimately can execute and oversee such a plan. *See Chapter 1.*

Strategy — A coordinated set of activities that are designed to help you achieve one or more of your goals in science education. A strategy should have a beginning and an end, and it should be designed to change something about the way your state does business in science education. Some strategies involve creating something new, while others involve changing or scaling up an existing practice. *See Chapter 4.*

Target — A target is the specific level of your metric that your state intends to reach by a given point in time. The target should be based on past performance and other evidence of what is possible. *See Chapter 5.*

Trajectory — A trajectory is a projection of a metric's path over time from its current level to the level suggested by the target. It is your best estimate of the how your system will perform at each point in time en route to achieving its overall target. *See Chapter 5.*

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Michael Cohen

President

Achieve

About Achieve

Created in 1996 by the nation's governors and corporate leaders, Achieve is an independent, bipartisan, nonprofit education reform organization based in Washington, D.C., that helps states raise academic standards and graduation requirements, improve assessments, and strengthen accountability. Achieve is leading the effort to make college and career readiness a national priority so that the transition from high school graduation to postsecondary education and careers is seamless. In 2005 Achieve launched the American Diploma Project Network. Starting with 13 original states, the network has now grown to include 35 states educating nearly 85 percent of all U.S. public school students. Through the ADP Network, governors, state education officials, postsecondary leaders and business executives work together to improve postsecondary preparation by aligning key policies with the demands of college and careers. Achieve partnered with the National Governors Association and the Council of Chief State School Officers on the Common Core State Standards Initiative and was selected by states to manage the Partnership for Assessment of Readiness for College and Careers assessment consortia. The PARCC consortium was awarded Race to the Top assessment funds to create next generation assessments in math and English aligned to the CCSS. Achieve is also managing a state-led process to develop K–12 Next Generation Science Standards based on the National Research Council's *Framework for K-12 Science Education.* For more information about the work of Achieve, visit www.achieve.org.

About U.S. Education Delivery Institute

The U.S. Education Delivery Institute (EDI) is an innovative nonprofit organization that focuses on implementing large-scale system change in public education. Its mission is to partner with K–12 and higher education systems with ambitious reform agendas and invest in their leaders' capacity to deliver results. By employing a proven approach known as delivery, EDI helps state leaders maintain the necessary focus to plan and drive reform. EDI provides intensive on-the-ground support, data analytics, ongoing professional development and a network through which state systems can collectively build their capacity. As a result of this work, EDI expects to increase the number of well-prepared students who graduate from high school then enter and succeed in college. EDI emphasizes actions to close the gaps that too often separate low-income students and students of color from others. Its success is based entirely on whether the partner systems achieve these aspirations. For more information about the work of EDI, see www.deliveryinstitute.org.

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