
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*
<p>a. Distinguish between atoms and molecules.</p> <p>b. Describe the difference between pure substances (elements and compounds) and mixtures.</p> <p>c. Describe the movement of particles in solids, liquids, gases and plasma states.</p> <p>d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).</p> <p>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).</p> <p>f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.</p> <p>g. Identify and demonstrate the Law of Conservation of Matter.</p>	<p>a. Develop molecular-level models of a variety of substances, comparing those with simple molecules to those with extended structures.</p> <p>b. Design a solution that solves a practical problem by using characteristic chemical and physical properties of pure substances.</p> <p>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.</p> <p>d. Analyze and interpret the properties of products and reactants to determine if a chemical reaction has occurred.</p> <p><i>*Note that these are only samples and do not necessarily reflect the final standards.</i></p>

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.



Achieve

