NextGenScience

WestEd

Key Takeaways from the Early Years of Transforming Science Education for the Next Generation

Acknowledgments

Thank you to the science education leaders who participated in focus groups to contribute their expertise to this project.

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This resource was developed with funding from Bill & Melinda Gates Foundation, Arconic Foundation, and Chevron Foundation. The contents of this product do not necessarily reflect the views or policies of the funding agencies.

Suggested citation: Sarna, J. & Wolbrink, V. (2020). *Key Takeaways from the Early Years of Transforming Science Education for the Next Generation*. WestEd.

WestEd is a nonpartisan, nonprofit research, development, and service agency that partners with education and other communities throughout the United States and abroad to promote excellence, achieve equity, and improve learning for children, youth, and adults.

Launched at WestEd in April 2020, NextGenScience works alongside educators to design quality, coherent programs that align science standards, instructional materials, professional learning, and assessments. For more information about NextGenScience, visit ngs.wested.org.

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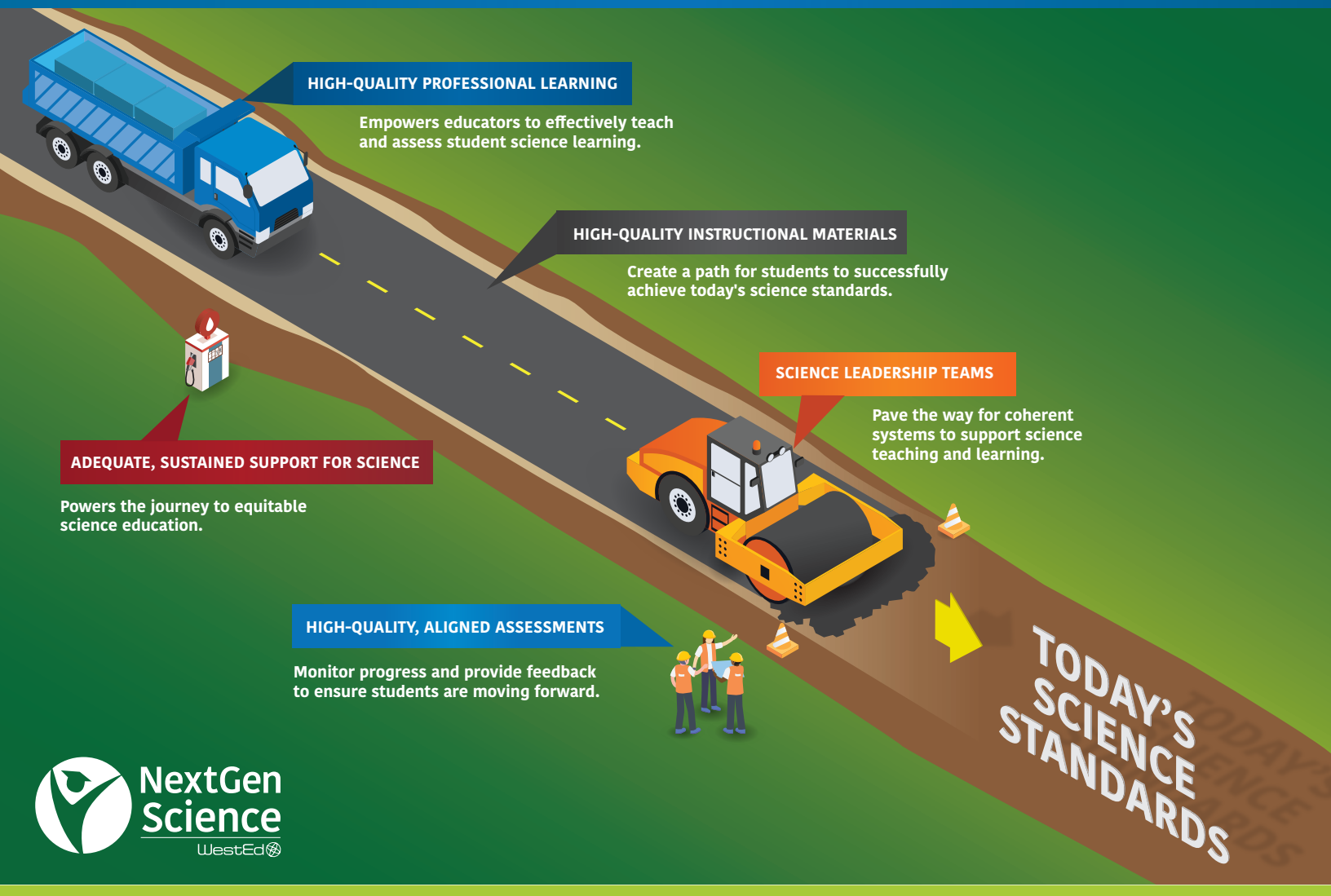
THE PATH TO EQUITABLE SCIENCE EDUCATION FOR ALL STUDENTS



The Next Generation Science Standards (NGSS) and similar science standards based on *A Framework for K–12 Science Education* were developed to level the playing field for all students. One of the most important factors for ensuring that all students experience equitable science instruction is access in every classroom to high-quality, standards-aligned instructional materials. Such materials enable students to use grade-appropriate ideas, practices, and concepts to make sense of relevant phenomena or to design solutions to actual problems. Standards-aligned materials provide a roadmap for teaching and learning and help ensure all students receive equitable access to science instruction that prepares them for college, careers, and citizenship.

Identifying Key Takeaways from the Early Years of Transforming Science Education for the Next Generation

Since 2013, nearly all 50 states have adopted the Next Generation Science Standards (NGSS) or similar standards based on *A Framework for K–12 Science Education*. These standards are designed around research that shows how students learn science best — by doing science, using the same practices as scientists. Lessons learned during the past seven years of implementing the NGSS offer invaluable insights as well as resources for districts and states undertaking or considering adopting these or similar science standards.

The NextGenScience team brought together a diverse group of educators and experts who had developed, adopted, and/or implemented instructional materials aligned with today's science standards. We organized them by their role in education:

- State, district, and school leaders
- Science classroom educators
- Science materials developers
- Third-party curriculum evaluators
- Science researchers and experts
- Professional learning providers
- Non-profit partners that support standards implementation

Then we conducted a series of focus groups in which we asked participants to share the essential lessons they learned about developing and delivering high-quality, equitable science learning experiences for all students. The findings from those focus groups are captured in the five key takeaways in this document.

Five Key Takeaways for Achieving Equitable Science Instruction for All Students

1

States, districts, and schools see positive outcomes when they invest time and energy into creating and sustaining science leadership teams to support the shifts in science education that today's science standards demand.

School system leaders set the vision for science instruction. To do this effectively, leaders think carefully and strategically about what it takes to support students in meeting the high expectations of today's science standards.

A science leadership team provides the necessary infrastructure and accountability for implementing the standards, which includes, among other things, ensuring all educators: (A) have access to high-quality materials, (B) are prepared to use those materials effectively in the classroom, and (C) are able to measure student learning through standards-aligned assessments.

Developing a team and strategy are foundational steps that set the stage for the rest of the work to implement the standards. Without a team and strategy, the process can be unclear or haphazardly implemented, which reduces the chances for meaningful, sustained shifts to take root in a system. When science leaders engage stakeholders around a common vision, backed by a careful plan for achieving that vision, students' science learning experiences and outcomes improve.

> **"As you think about priorities and shift into adoption, planning is essential. You need to have a clear vision for science education before you look at materials"**
>
> *—Partner Organization Director*

Resources Connected to This Takeaway

NGSS District Implementation Indicators: This document provides some key common indicators of successful NGSS implementation at the district level, as well as some concrete actions that districts can take to achieve their implementation goals.

NGSS District Implementation Workbook: This workbook provides an overview of the issues and challenges associated with NGSS implementation and outlines some key questions, timelines, decisions, and considerations for district leaders.

Lessons Learned from the NGSS Early Implementer Districts: Instructional Materials: Achieve interviewed nine of the 10 districts in the **California NGSS K–8 Early Implementation Initiative** and compiled that information into a resource that highlights district experiences and instructional materials.

The Leading by Convening (LbC) Framework: This resource includes a variety of tools and protocols to support education leaders with building teams focused on improving educational outcomes for students.

2

To make the shifts in science education that today's science standards demand, educators and students need access to **high-quality instructional materials.**

Why Materials Matter

While the standards lay out the skills and knowledge students should have acquired by the end of instruction, a high-quality curriculum designed for the standards charts the pathway that helps students reach proficiency in the standards. Instructional materials are a key to achieving equity because they have a huge impact on learning experiences and outcomes for students, **particularly those living in poverty and from non-dominant communities**.

The Features of High-Quality Materials

High-quality materials designed for today's science standards enable students to use grade-appropriate ideas, practices, and concepts to make sense of relevant phenomena or to design solutions to actual problems. With these materials, educators can create environments where students have multiple opportunities to build on prior knowledge, share ideas, and make use of the practices of scientists and engineers.

It's challenging to update old curricula to ensure they are designed for today's science standards. The most effective materials that reflect the innovations of the *Framework* are built from the ground up. Many curriculum developers are making progress creating new, high-quality curricula.

Selecting High-Quality Materials

As educational leaders plan the implementation of new science standards, one of the most important decisions they face is selecting instructional materials to support student learning. This process is most effective when it begins by engaging a variety of stakeholders in meaningful dialogue, learning about the features of quality materials, and carefully evaluating materials for alignment to today's science standards. A review process that includes stakeholder buy-in, clear criteria, and careful evaluation of evidence from the materials enables schools and systems to select the best possible materials.

> **"I'm shocked and amazed by how teachers are open to learning through this process. Instructional materials that show what it looks like for students to be scientists and own their learning offer teachers a deeper understanding of the standards. Materials have to support and scaffold instructional shifts."**
>
> *—Professional Learning Provider*

Resources Connected to This Takeaway

Indicators of High-Quality Materials

- **Quality Examples of Instructional Materials:** NextGenScience publicly posts NGSS lessons and units that are highly rated by the Peer Review Panel for Science and includes the units' EQuIP feedback to provide evidence for their ratings. All educators can learn from and use these lessons and units.
- **NGSS Design Badge:** NextGenScience awards a symbol of excellence called the NGSS Design Badge to science units designed for the NGSS that have earned the highest rating on the EQuIP Rubric for Science, based on a review conducted by the NextGenScience team or the Science Peer Review Panel.
- **EdReports Full Program Reviews:** EdReports reviews and publicly posts evaluations of full science programs, describing their alignment to standards and other indicators of quality.

Tools for Evaluating Instructional Materials

- **NGSS Lesson Screener:** The NGSS Lesson Screener provides criteria for reviewing the degree to which lessons and units are designed for the NGSS.
- **EQuIP Rubric for Science:** The EQuIP Rubric for Science provides criteria for measuring the degree to which longer lessons and units are designed for the NGSS.
- **NextGen TIME:** NextGen TIME is a suite of tools and processes for curriculum-based professional learning that supports educators in evaluating, selecting, and implementing instructional materials designed for next generation science.

Services for Reviewing Instructional Materials

- **Science Peer Review Panel:** The Science Peer Review Panel (PRP), coordinated by NextGenScience, is composed of expert educators who identify lessons and units that best illustrate the cognitive demands of the NGSS.
- **NextGenScience Reviews:** NextGenScience is working to identify more high-quality materials designed to support implementation of the NGSS. We review those materials confidentially.

Tools for Evaluating Assessments and Assessment Tasks

- **A Framework for Evaluating Cognitive Complexity in Science Assessments**: This resource offers a new approach to capturing and communicating the complexity of summative assessment items and tasks designed for today's science standards.

Additional Resources for Identifying Quality Materials

- How **One District Reviewed NGSS Materials With a Lens for Equity**
- **NGSS Innovations and Instructional Materials:** The NGSS Innovations are the five most significant ways the NGSS advance science teaching and learning. This document describes the five innovations and their implications for instructional materials.
- **NGSS Alignment Claims: How Publishers Talk About the Next Generation Science Standards:** This document categorizes and describes some of the common ways those developing and marketing science instructional materials make claims about their connections to the NGSS.
- **Lessons Learned from the NGSS Early Implementer Districts: Instructional Materials:** This document shares lessons learned from interviews with nine of the 10 districts in the California NGSS K-8 Early Implementation Initiative and highlights district experiences with instructional materials.

> **"High-quality materials call for lots of student discourse; teachers blend in with everyone else. When we have high-quality materials that teachers can use, teachers can start to create learning environments where students are leading the conversation."**
>
> *—District Science Leader*

3

Materials matter, but materials alone won't transform science education for the next generation. Educators and leaders need ongoing opportunities to engage in high-quality professional learning that is closely tied to classroom instruction and positions educators as both learners and professionals.

Curricula designed for today's science standards call on teachers to shift their instructional approach from sage-on-the-stage to guide-on-the-side. Standards-designed materials give students the opportunity to make sense of the world around them by observing real-world phenomena, bringing their own ideas and experiences to the table, asking questions, and investigating those questions. For teachers and leaders alike, this is a significant change.

To realize those shifts, educators need more than professional learning that just unpacks the standards. They need high-quality, ongoing professional learning experiences that are closely tied to what teachers actually do in the classroom. Curriculum-based professional learning enables educators to experience, practice, and reflect on NGSS-designed materials. Such professional learning can deepen educators' expertise in: (A) science content, including their understanding of disciplinary core ideas, crosscutting concepts, and scientific and engineering practices; (B) science pedagogy, including practices that support rigorous student learning; and (C) strategies for meeting the needs of all learners.[1] These professional learning opportunities honor educators' experience and expertise by aligning meaningful support with quality curriculum.

Once school systems select high-quality and aligned materials designed for today's science standards and establish a professional learning plan, teachers need a safe space to learn, try out strategies, and receive feedback. Meanwhile, science leaders need ongoing training and support around what to look for in classrooms to promote teacher growth. Instituting these opportunities can generate the greatest change in teacher practice and student learning.

"Professional development is essential and expensive, and leaders are hungry for it. We need to offer safe spaces for continuous learning at all levels."

—Professional Science Leader

"Even if you give teachers high quality materials, they still need professional learning opportunities to know how to use them."

—Science Education Researcher

Resources Connected to This Takeaway

Science Teachers' Learning: Enhancing Opportunities, Creating Supportive Contexts: This National Academies of Sciences, Engineering, and Medicine report from 2015 shares the latest research on how to effectively support science teachers.

The Mirage: Confronting the Hard Truth About Our Quest for Teacher Development: This report by TNTP examines what it takes to support teachers with effective professional development.

Lessons Learned from the NGSS Early Implementer Districts: Professional Learning: This document shares lessons learned from interviews with nine of the 10 districts in the California NGSS K-8 Early Implementation Initiative and highlights district experiences with professional learning.

The Elements: Transforming Teaching through Curriculum Based Professional Learning: This resource from the Carnegie Foundation provides essential guidance for designing impactful professional learning.

[1] *https://www.nap.edu/read/21836/chapter/2?term=three+important+pieces+of+professional+learning#3*

4

High-quality, aligned assessments are an important signal and tool to more effectively monitor student learning and generate better science outcomes.

Today's science standards represent a shift in learning goals from memorizing facts to developing a deeper understanding of ideas, practices, and concepts that can be used to make sense of the world. That shift has implications for measuring whether students have met their learning goals. Just as instruction must change, so must assessments. They should be focused on making sense of uncertainty associated with a phenomenon or problem by using both science knowledge and practices together.

High-quality assessments are an important tool to support better science outcomes and signal needed changes in instruction. The field is still developing support for educators to monitor their students' learning. However, rather than having one test as the sole measure of success, a more effective strategy is to have a coherent system of assessments that includes varied and innovative assessment opportunities to gather information for different audiences and purposes (e.g., classroom teachers to inform instruction, district and state leaders to inform programmatic and policy decisions).

> **"It takes a lot of policy and advocacy work to be sure the school board supports this type of work. How can you change the narrative to show you're having success? What's the work around social justice that matters to your community, and how does science play a role? How do you get the momentum and support to move on the things that really matter?"**
>
> *—Partner Organization Director*

Resources Connected to This Takeaway

Steps to Enact Statewide Systems of Assessments in Science: A Guide for State Policymakers: This document provides a guide for policymakers as they consider how to develop and implement assessment systems in science.

Task Annotation Project in Science: The Task Annotation Project in Science (TAPS) was launched to provide an answer to the questions "what does it look like to ask students to demonstrate progress toward three-dimensional standards?" and "what are the most important features of high-quality science tasks?" This suite of resources includes annotated examples of assessment tasks for elementary, middle, and high school as well as a series of short resources that highlight the major takeaways across the whole project.

Science Assessment Task Screening Tools: The Science Task Prescreen and the Science Task Screener can assist educators in evaluating science assessment tasks to determine whether they are designed for today's science standards.

A Framework for Evaluating Cognitive Complexity in Science Assessments: This resource offers a new approach to capturing and communicating the complexity of summative assessment items and tasks designed for three-dimensional standards.

Next Generation Science Standards District Implementation Workbook: This workbook is designed to help current or aspiring district leaders — from board members and superintendents to science coordinators and teachers — improve science education for students in their schools and communities.

5

Shifting to the teaching and learning necessary to meet the expectations of today's science standards requires systemic change. School systems should invest in adequate, sustained support for science to develop and maintain an effective, coherent science education program.

The innovations of today's science standards call for states and districts to shift their approach to student learning, materials selection, professional learning, elementary science schedules, scope and sequence, and funding. Classroom teachers are dedicated to doing their part to transform science classrooms, but they can't succeed without supportive systems and communities of practice. Investing in our students' futures will require careful attention to the infrastructure required to improve science teaching and learning and investments in resources for students and educators.

> **"For everything that is happening in the classroom, we need infrastructure and funding. We need to think carefully about what we do with materials. We need people with more knowledge to support the changes we want to see in classrooms."**
>
> *—District Science Leader*

Resources Connected to This Takeaway

Next Generation Science Standards District Implementation Workbook: This workbook is designed to help current or aspiring district leaders — from board members and superintendents to science coordinators and teachers — improve science education for students in their schools and communities. Chapter 2 addresses adequate and sustained science funding.

NGSS District Implementation Indicators: This document provides some key common indicators of successful NGSS implementation at the district level, as well as some concrete actions that districts can take to achieve their implementation goals.

The State of State Science Education Policy: Achieve's 2018 Science Policy Survey: This report summarizes findings from a science policy survey administered during the summer of 2018 to state education agencies to better understand state-level science education policies.