Lessons learned:
Making the shift to the NGSS

A guide from the Amplify Science team
Adopting the Next Generation Science Standards (NGSS) requires a next-level commitment from teachers, schools, and districts. But since they’re now in use in at least 18 states, with more to come, more and more educators today know from experience what the process really takes. We asked some of our district and school partners across the country to help make your process easier by sharing their most important lessons learned.
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Introduction

The Next Generation Science Standards were introduced in 2013 with the purpose of ensuring that the next generation of Americans has the tools to understand and make informed decisions about the world around them.

States had been using the National Science Education Standards from the National Research Council (NRC) and Benchmarks for Science Literacy from the American Association for the Advancement of Science (AAAS) to guide the development of their standards. Those documents are known to be sound, but are also more than 15 years old, and therefore missing virtually all the scientific—and pedagogical—advances that occurred during the lifetimes of their target audience.

But the new standards do not just introduce new content or a new “approach.” They incorporate three integrated dimensions: core ideas (content), science and engineering practices (methodology), and cross-cutting concepts (underlying ideas). And they require a profound and fundamental paradigm shift in the delivery of science education: from imparting scientific knowledge to encouraging scientific thinking—that is, from “learning about” to “figuring out.”

Therefore, when it comes to the process of comprehending and aligning to the standards, for teachers too, “learning about” doesn’t suffice. Educators, schools, and districts have had to embark on multi-year processes of “figuring out.”
The challenge

And sure enough, there is plenty to figure out. When asked to describe their reaction to their first glimpse of the standards, educators frequently use words like “intimidated” and “overwhelmed.” Says Emily Elasky, who teaches eighth-grade science and STEM at Asa Mercer International Middle School in Seattle, WA: “At first, just looking at one page of a performance expectation almost shut me down because there’s just so much information. And there’s an entire binder full.”

“‘You’re no longer a disseminator of knowledge,’” Jared Marr, staff development and curriculum specialist-STEM in the Tulare County (CA) Office of Education, tells teachers when he trains them on NGSS. “‘You’re a curator of curiosity.’”

Perhaps even more challenging than the sheer volume of information is the fundamental shift in pedagogical practice that the standards demand.

Standard practice before NGSS: teachers and textbooks deliver or “front-load” information; then students explore and experiment with it in order to grasp it.

Now, with NGSS: activity comes before content (“ABC”). “‘You’re no longer a disseminator of knowledge,’” Jared Marr, staff development and curriculum specialist-STEM in the Tulare County (CA) Office of Education, tells teachers when he trains them on NGSS. “‘You’re a curator of curiosity.’”

It’s an idea more easily embraced in theory than enacted in practice, say teachers. What does that shift look like in real-life lessons—and how does it redefine their own role? “The teachers were very used to textbooks. It was a leap of faith,” says Karla Orosco of Central Union School District, CA, who has been teaching science for 25 years and whose introduction to NGSS came through field-testing Amplify Science. “We wondered, ‘How are the students supposed to arrive at the same conclusion as my lecture? How many labs are we talking about here? When a lesson is ‘student-centered,’ how can I be most effective?’”

“‘None of us was taught to teach this way,’” adds 30-year teaching veteran MaryMargaret Welch, now science program manager for Seattle Public Schools. “‘Teachers already juggle managing the class, engaging the students, attending to the multiplicity of learning styles. Then NGSS asks them to think completely differently about how they structure their work. This is not business as usual. It’s a shift in pedagogical practices. It’s a very heavy lift.’”
Lessons learned

Implementing NGSS is a heavy lift. But when teachers get the support, time, and resources they need, from their peers and communities, and from field experts and top-quality products, they can make it happen—and can indeed help build the next generation of curious, capable scientific thinkers.

Here, educators who have implemented NGSS, in schools and districts of various sizes and types across the country, share what it takes to truly “figure it out.”

It takes a paradigm shift.

“The ‘scientific method’ is old now. It’s SEPs (Science and Engineering Practices), not a straight line.”—Karla Orosco, science teacher in Central Union, CA

First, it’s important to simply make clear to all, that teaching to NGSS does require a seismic shift. “It’s going to be a mindset change. It’s going to be different from the way they’ve taught before. Everyone needs to go in with that understanding,” says Julie McCormick, lead science teacher, St. Mary’s Catholic School, Rome, GA.

And how to actually make that shift? Many teachers say what worked best for their own learning process was to acquaint themselves with the NGSS pedagogical approach first—to understand how to guide a lesson before focusing on the content being taught. (This parallels the way the students learn, too—starting with how to think scientifically rather than absorbing facts.) “You have to watch a lesson, see it written out or do it yourself—experience it—and then go back to the standards and say, ‘OK, what were the SEPs?’” says Karla Orosco of Central Union School District in CA. Teachers know how DNA works and why volcanoes erupt: it’s important to observe NGSS-based lessons (see the Resources section at the end) to see how the 3-D approach comes to life in class, and how other teachers guide students from observing phenomena and exploring questions to building their own conclusions.

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Julie McCormick
Lead science teacher, St. Mary’s Catholic School, Rome, GA
It takes time.

“There is no way you can jump into this. You’re always doing a little of the old while trying something new. There’s a lot of risk and failure. And you have to give the kids time to adjust, too.”—Karla Orosco, science teacher in Central Union School District, CA

If you’ve been down this road with the Common Core, you know: alignment will not happen overnight. In fact, plan on three years, minimum—ideally, even more. “Once you digest that this is going to be a multi-year process, then it’s not so overwhelming,” says Brian Suter, science coordinator and lead science teacher for the Neshaminy School District in PA. “It’s iterative. You’ll constantly be going back and revising and gradually moving yourself toward full implementation of NGSS.”

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Science coordinator and lead science teacher, Neshaminy School District, PA

Note: Some teachers say that when they hear of schools or districts planning to roll out faster, what they’re really doing is implementing the disciplinary core ideas (DCIs) at NGSS grade levels, i.e. moving mastery of a given concept from from middle school down to 5th grade. That’s only part of the process. Getting kids—and teachers—to master those DCIs along with the practices and cross-cutting concepts (that is, in a 3-D way) will take significantly longer.
It takes partners and professional development.

“We need to help teachers understand the importance of this shift in practice and what it looks and feels like every day. For that, you need consistent professional learning—opportunities for teachers to have meaningful conversations with colleagues, under the direction of people who know what the shift looks like. I do have teachers come together to do sense-making themselves, but often it’s the blind leading the blind. We need resources provided by people who have a lot more time than classroom teachers. You can’t pull this off, or keep it up, without giving teachers a learning space.”—MaryMargaret Welch, science program manager for Seattle Public Schools

Some teachers and schools have moved to NGSS on their own, but they say that should not be plan A. “We’re at an age when people devalue formal professional development, but we were fortunate that Amplify and Lawrence Hall of Science trainers worked hands-on with us. It’s so important for understanding the dimensions of NGSS,” says Brian Suter of the Neshaminy School District in PA. And, ideally, that expert support will continue even after initial implementation. Adds Suter: “Teachers need it to make—and sustain—the paradigm shift required by NGSS. Without some form of ongoing PD, it’s so easy to slip back into the ‘old ways.’”

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MaryMargaret Welch
Seattle Public Schools, WA

Through partnerships with local universities, publishers, and other professional learning organizations, many schools or districts are able to provide teachers with intensive trainings, dedicated consultants, summer workshops, conferences (state, regional, or national), and more. “Support looks different from place to place, and each school or district has its own unique challenges, but support for teachers is essential—don’t let them be an island,” says Jared Marr of the Tulare County (CA) Office of Education.

Also important: **PD is not just for teachers.** “You need to bring the administrators along,” says Katie Ramsey of Grand Island Public Schools in Nebraska. “They need the PD as well to see what these shifts are and how it’s going to look different in the classrooms. They’ll be in there evaluating teachers and if they don’t understand the shift to 3-D instruction, they won’t be able to to provide the instructional leadership they need. They need to understand how different this is for teachers and put the PD in their budget.”
It takes participation by all stakeholders.

“It’s important to connect with the entire community and let them know what you’re trying to accomplish, because you can’t make this happen alone. It takes a community of practice, and you need everyone on board.” —Jared Marr, Staff Development and Curriculum Specialist-STEM, in the Tulare County (CA) Office of Education

Adoption of the NGSS requires the participation of everyone in your educational ecosystem.

Teachers

Collaboration with peer teachers is needed not only to learn the standards, but also to coordinate curriculum and skill-building across grades and subjects, especially in those places where the NGSS overlaps with ELA and math standards. Even before that, “It’s critical to identify early on teacher leaders who are going to be catalysts for change,” says Brian Suter of Neshaminy School District in PA. Likewise, administrators should involve those representative teachers in planning and implementation from the beginning.

Administrators

When it comes to administrators and NGSS, “‘buy-in’ is good, but involvement is necessary,” says Katie Ramsey of Grand Island Public Schools in Nebraska. “I encourage administrators to take an active part as learners with their teachers.” That helps them understand the new dimensions of the standards and equips them to support current and new teachers on aligning to them.

Parents

Teachers say it’s invaluable to involve families in the process so that they know what to expect. (“Mom and Dad are going to want to see a midterm!” says Brian Suter.) Schools often open up PTSA meetings for parent input about the transition to NGSS.
It takes state-of-the-art products and resources.

“You can’t have quality education without quality products,” says MaryMargaret Welch of Seattle Public Schools, adding that today, there’s a certain quality that only digital-forward products, like Amplify’s, can provide. “These days, books are old as soon as they’re published. Kids need digital literacy as well. Digital also provides so many wonderful opportunities to help kids visualize things that are invisible.”) That’s why Amplify Science combines the expert NGSS-aligned content and pedagogy authored by U.C. Berkeley’s Lawrence Hall of Science with today’s best practices in digital learning and design.

When Julie McCormick of St. Mary’s Catholic School in GA first encountered the NGSS, she says, “I read them, but I had no idea how to make them happen. You could take literally an entire day, or more, to write one lesson. I had no idea how I was going to do it.” She heard of Amplify Science at an NSTA meeting, found out it was (as she put it) “Lawrence Hall’s answer to the NGSS,” and made a successful case for buying it, even for her small school.

Amplify Science provides robust teacher support, both embedded resources in the digital curriculum and powerful professional learning opportunities (in-person and online). There are also numerous other materials and learning opportunities that teachers find indispensable as they learn about and adjust to the instructional shifts required by the NGSS. They include:

- A Framework for Science Education
- The NGSS appendices, which provide background and detail about the standards, plus some implementation models
- NGSS Evidence Statements
- NGSSphenomena.com
- NSTA website and conferences
- State-level science organizations
- @NGSSchat on Twitter
- NGSx.org
- Bozeman Science
- Sample NGSS lessons posted on YouTube
- Sample Amplify Science units
Case studies

Grand Island Public Schools, NE

Process snapshot
The district decided to go with NGSS in 2013 and rolled out K–8 in 2017. Right after approval in 2013, a team of science teachers got together to study and research and “just try to figure this whole thing out,” says Katie Ramsey, PK–12 science coordinator and former science teacher and coach.

The team met on 20 days during the school year and five days each summer. They started by focusing on one standards page at a time and asking, “What does this mean?” Then they turned to unpacking the three dimensions—SEPs, DCIs, CCCs—and the required skills. Then (with the guidance of a consultant) they created curriculum maps starting with K–8, and then 9–12.

Challenge
“We were basically on our own. There’s a lot more support now, but then, we were the only district in NE who was doing it. I led the process, so I just tried to stay a step ahead and learn as much as I could,” says Ramsey. The team did rely on outside help as the need presented itself; for example, they brought in some university experts to help them understand and design for the engineering elements of the standards, which were totally new for them.

Key takeaway
“Connect yourself with experts—people who have been there,” says Ramsey. In her district, now she and her original team are experts, providing professional development at the state level and playing a large role in selecting instructional resources.
Seattle Public Schools, WA

Process snapshot

Teachers were trained by working to modify existing lessons to match the new standards. Example: Rather than lecturing about ecosystems using the example of salmon, applying a Claim, Evidence, Reasoning (CER) framework to have students take and defend a position on why a given salmon population is increasing or decreasing. Note: “At one point we had 10 people working for a week and we didn’t finish one unit. It was a great experience of a deep dive into a performance expectation and how to center the lesson on the kids,” says teacher Emily Elasky, but many educators agree that finding high-quality aligned curriculum is much more efficient and effective than do-it-yourself modification or creation.

Challenge

Classrooms “figure out” at different paces. “Before, when students were challenged to answer a question or solve a problem, there was always a big day with the REVEAL. Now we never actually tell them the answer. If a given class is not there yet, we keep giving them more pieces of information until they do. Right now, that’s the biggest thing: navigating and keeping track of where each class is in understanding so that each day we pick up where that particular class left off,” says Emily Elasky, who teaches eighth-grade science and STEM at Seattle’s Asa Mercer International Middle School.

Key takeaway

Collaborate and integrate NGSS with other standards and skills across grades and subjects. “We’ve done coordination with non-fiction reading strategies and writing Claim, Evidence, and Reasoning statements so that we’re using similar language between science and ELA. We look to see when certain math skills are taught, so we know that physical science with graphing has to happen in eighth grade,” says Elasky. “All the best work we did on NGSS was in collaboration with other teachers.”
St Mary’s Catholic School, Rome, GA

Process snapshot
St. Mary’s adapted NGSS three years ago, making a few adjustments for elements of Catholic education. Julie McCormick, the middle school’s only science teacher, became familiar with them through that process itself.

Challenge
Translating the pedagogical paradigm shift into practice. “The NGSS require a whole new way of thinking and teaching. It’s so much more about how to think than learning a bunch of facts. I had no idea how to make that actually happen,” says McCormick. “Early on, it would take me literally a day or more to write one lesson.”

Key takeaway
Learn by doing, like your students. For example: “After much trial and error, I realized that there are many things that ‘count’ for elements of the lessons—like, ‘modeling’ or ‘engineering’ something doesn’t have to mean ‘building’ it. It can be on a piece of paper, or computer,” says McCormick. Bottom line, “the first year will feel like one big experiment”—and of course, that feels like science.