

NGSS Instruction: A Powerful Lever for Equitable Learning, Language Development, and Learning in Other School Subjects

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From 2014 to 2020, the Next Generation Science Standards (NGSS) Early Implementers Initiative supported several K–8 school districts in implementing the NGSS, which call for substantial changes in science teaching and learning. This brief describes some key results and takeaways from WestEd’s evaluation of the initiative, which found that NGSS teaching:

- » Fosters strong student engagement and deep learning for K–8 students, particularly for students who have often been inadequately reached through traditional science instruction.
- » Has natural synergy with the core subjects of English language arts (ELA) and math, and supports language development.

The brief discusses how the NGSS engage students more deeply and integrate effectively with other subjects — and why it is critical to ensure that all students have access to effective NGSS instruction, even during COVID-triggered distance learning.

Students Benefit Greatly from NGSS Instruction

As the NGSS are implemented, children’s science learning can become more powerful, exciting, and equitable. Indeed, Early Implementer teachers and administrators reported that NGSS instruction strongly benefited students in the following ways (Tyler et al., 2018):

- » **NGSS instruction reaches all students** — Lessons are accessible to English Learners and students with special needs.
- » **More students were more engaged** — NGSS is driven by students posing their own questions.
- » **Student learning was deeper** — NGSS teaching methods foster more complex reasoning.

NGSS instruction allows more equitable access to learning.

In the past, K–8 science instruction was largely about having students conduct prescribed labs, recall isolated facts, and remember the “right” answers. By contrast, in the NGSS classroom, the focus is on students making sense of scientific phenomena through exploration, problem-solving, collaboration, and creating scientific models based on evidence. When initially presented with phenomena, students are often captivated and curious, and the NGSS are designed to encourage students to explore and ask questions accordingly.

One middle school teacher explained, “NGSS teaching is positive for all, but we’re reaching students that we might have not reached — giving them self-confidence and getting their interest and tying it into their experiences.”

Focusing on science in students’ lives and cultures engages them.

When teachers plan instruction around phenomena that reflect what students experience in their local environments and communities, those experiences serve as bases on which to construct meaningful and

memorable academic learning. Rather than having students recall isolated facts that they may forget immediately after a test, the NGSS aim to engage students' prior knowledge to facilitate deeper learning that students can continue to build on.

NGSS instruction fosters deeper learning.

Over 90 percent of surveyed teachers and administrators reported that the NGSS's student-driven, phenomena-based instructional model was having a positive effect on low-performing students' learning, and one-third of surveyed teachers and administrators (36 and 34 percent, respectively) perceived a "substantial" change compared to pre-NGSS instruction (Tyler et al., 2018).

Science taps into the natural curiosity and energy of young people. Because NGSS science is inquiry-based and student-centered, it engages and motivates students to step up and apply themselves to challenging tasks (Gomez-Zwiep & Straits, 2013; Worth, Winokur, Crissman, Heller-Winokur, & Davis, 2009). A district project director in the Early Implementers Initiative remarked, "When the vision of the NGSS is at play in learning experiences, students tend to be so engaged, they don't really 'realize' they are reading, writing, engaging in mathematics, or developing rich vocabulary."

Science Supports Language Development and Learning in Other Subjects

Science instruction is not only important for the sake of learning science, it also helps all students develop and hone their language skills and provides an engaging, real-world context for learning.

Science supports language development.

For years, English Learners have been pulled out of science classes to make time for focused instruction in English. Even in the NGSS Early Implementers Initiative, some districts initially "protected" ELA in the elementary grades by prohibiting any science teaching during scheduled instructional time for reading and writing.

The NGSS classroom provides an environment in which science learning and language learning can occur simultaneously. In fact, integrated science teaching is fully consistent with the intent of the Common Core State Standards for ELA (2013) and the California English Language Development Standards (2014), and research suggests that science instruction increases learning in reading, writing, and science simultaneously (Brown & DiRanna, 2013).

In Early Implementor districts, science learning compellingly contributed to language development, as students used new language when collaboratively planning and conducting investigations, developing and labeling models to show their thinking, supporting their claims with evidence, and/or communicating their explanations orally and in writing (Tyler et al., 2017).

Some Early Implementer teachers noted that the exploration and deeper reasoning called for by the NGSS can lend themselves to different types of writing and argumentation often taught in ELA, while others noticed students using vocabulary learned in science when discussing other subjects. Teachers also remarked that, during science activities, English Learners were eager to participate, express their findings, and ask questions. They reported that, when doing science, these students took more risks and seemed to feel more comfortable speaking, reading, and writing than when learning other subjects.

Science integrates effectively with other core subjects.

The NGSS are designed to integrate with other subjects. For each core science concept, the NGSS provide guidance for teachers to plan cross-subject lessons by listing Common Core State Standards for ELA and mathematics that are associated with the concept (NGSS Appendix L & M, 2013). In science, students learn skills similar to those that they are called upon to use in ELA/literacy and mathematics, such as backing up claims with evidence, constructing explanations, and obtaining, evaluating, synthesizing, and communicating information.

In addition, because science engages students' natural curiosity about the physical world around them, it can be leveraged to engage student interest in related learning in other subjects. For example, science provides an excellent context for introducing and reinforcing math learning by providing a context for practical application of abstract reasoning and quantitative relationships. An elementary school teacher explained:

The math teacher was doing volume, but the kids weren't getting it. . . . So, we did a displacement activity with baseballs in water — they observed, drew, and talked over multiple days. By the time we were finished, the students had it down. When they took the math test, they talked about science. It was getting to apply [the math in a real-world, science context] — not just getting it from a book.

The repetition and reinforcement of core ideas, practices, and crosscutting concepts across subject areas offers multiple entry points to build and deepen understanding for students.

Early Implementer administrators came to see the value of integrating instruction in science with instruction in other school subjects. In fact, about two-thirds of Early Implementer teachers reported that their principals were supportive of them teaching science integrated with ELA during time allotted for ELA. And, as one district-level administrator commented:

Where we're at now is that administrators' eyes are open to the integration piece. That's been the big "aha" for them — that I can get more bang for my buck by pushing science than I can by just pushing reading and math and English. They're seeing the ways that integration should happen among a variety of subjects, not just with science.

Note that the administrator mentions "a variety of subjects." Many Initiative elementary school participants reported changing their teaching practices in all subjects, not just science. They felt that the

bedrock pedagogy in NGSS — supporting active student investigation that starts with prior knowledge and prioritizes discourse, collaboration, and "figuring things out" — had the potential to transform and deepen student engagement and learning in any school subject.

Recommendations

Ensure that all students have equal access to NGSS teaching and learning.

The Initiative showed that historically underserved and previously underperforming or disengaged students can benefit from NGSS instruction in meaningful ways, including gaining confidence that they can succeed. As one grade 3 teacher said, "It's funny, students are not confident in other areas, but in science we all don't know. I ask, 'Why?' and all students come up with hypotheses, all on the same level. Kids who don't usually excel come up with great ideas." In order for districts to ensure that students have equal access to effective NGSS instruction, teachers need ongoing professional development, opportunities to plan and collaborate with peers, and encouragement from administrators.

Keep the NGSS in all policy discussions — especially as decision-makers work to recover and rebuild from COVID-19.

Science is an important foundational subject that fosters ways of thinking and reasoning that students need to make sense of and participate in the world around them. Education leaders and policymakers in California must not allow science to remain on the back burner. As districts and teachers scrambled to figure out online teaching in 2020, the Common Core subjects of math and ELA were generally the dominant focus. But, as NGSS Early Implementer teachers found, NGSS science instruction can support and create more access points for learners in these core subjects. And, as described throughout this policy brief, the NGSS foster deep, equitable learning for all students. For these reasons, the NGSS should be included in all policy discussions.

References

Brown, Z. A. & DiRanna, K. (2013). *Equal access to content instruction for English learners: An example from science*. WestEd.

California Department of Education. (2013). *California Common Core State Standards: English language arts & literacy in history/social studies, science, and technical subjects*. Faye Ong & John McLean (Eds.), Gustavo Gonzalez & CDE Press.

California Department of Education. (2014). *California English language development standards*. CDE Press.

California Department of Education. (2013). *California Common Core State Standards: Mathematics*. Faye Ong & John McLean (Eds.), Gustavo Gonzalez & CDE Press.

Gomez-Zwiep, S., Straits, W. J., Stone, K. R., Beltran, D. D., & Furtado, L. (2011). The integration of English language development and science instruction in elementary classrooms. *Journal of Science Teacher Education*, 22(8), 769–785.

Lee, O., Quinn, H., & Valdés, G. (2013). Science and language for English language learners in relation to Next Generation Science Standards and with implications for Common Core State Standards for English language arts and mathematics. *Educational Researcher*, 42(4), 223–233. <https://doi.org/10.3102%2F0013189X13480524>

NGSS Lead States. (2013). *Next Generation Science Standards: For states, by states*. The National Academies Press.

Tyler, B., Britton, T., Iveland, A., Nguyen, K., & Hipps, J. (2018). *Engaged and learning science: How students benefit from Next Generation Science Standards teaching*. WestEd.

Tyler, B., Britton, T., Nguyen, K., Iveland, A., Hipps, J., & Schneider, S. (2017). *The synergy of science and English language arts: Means and mutual benefits of integration*. WestEd.

Worth, K., Winokur, J., Crissman, S., Heller-Winokur, M., & Davis, M. (2009). *The essentials of science and literacy: A guide for teachers*. Heinemann.

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