# **logo for the New Jersey Department of Education's Standards Transparency and Mastery Platform**

# **Contemporary Science Instruction in Grades K-5**

## What Is the Issue?

Children learn science and engineering best by engaging from an early age in the kinds of practices used by practicing scientists and engineers. By harnessing their natural curiosity and sense of wonder, children can be empowered to use their growing understanding to make sense of questions and problems relevant to them. By “doing” science and engineering, children can develop and refine their understanding of the disciplinary core ideas and crosscutting concepts of these disciplines. This approach can make learning more meaningful, equitable, and lasting (National Academies of Sciences, Engineering, and Medicine, 2023).

This type of instruction is far removed from a cookbook-type experiment that many of us experienced. Because students arrive at their findings by asking questions, investigating, gathering evidence, and revising their understandings, what they learn is more likely to stick with them. For example, please see [*Why do some things wash up on the beach and others don’t?*](https://docs.google.com/document/d/13IHpVbKj4S1zhrF70SeFdZTmGlVz2ZPYFovC7JjFlm4/edit)

## Why It Matters to You

**Educators:** All students have the right to learn about science and engineering in ways that are consequential and compelling to them. There are many different ways that learner interests can be meaningfully taken into account during instruction—by creating experiences, by adapting curriculum, or by resourcing and positioning students as sense makers.

**School Leaders:** There are multiple reasons for science to be a core part of elementary school learning. It can support: (a) development of a knowledgeable citizenry, (b) meaningful learning of language and mathematics, (c) wonderment about how the natural world works, and (d) sets the stage for future learning.

## Things to Consider

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| Three-dimensional learning uses science and engineering practices to actively engage students in science learning, integrating these with disciplinary core ideas and crosscutting concepts, and explaining phenomena and/or designing solutions to problems to drive student learning |

* Three-dimensional instruction better reflects what scientists do than traditional instruction does. In three-dimensional learning, students are continually expanding and deepening their knowledge, rather than memorizing a collection of static science facts.
* The three-dimensional approach is also more rigorous—and vigorous!—than traditional instruction because it recognizes that students need to do more than just learn the content (core ideas) of science disciplines; students also need to understand the crosscutting concepts that connect disciplines and be able to actively use their growing knowledge to answer questions and solve problems, as real scientists and engineers do.
* A three-dimensional approach shifts the goal of learning from “defining and understanding” science ideas to “developing and using” knowledge. (National Research Council, 2012, p. 7-8).

## Key Features of Contemporary Science Instructional Materials

Contemporary science units and lessons:

* Anchor instruction in investigating phenomena and solving design challenges.
* Engage children in science and engineering practices as a means to build knowledge and use that knowledge to answer questions and solve problems.
* Focus on learning experiences that are meaningful and relevant to the real-world, and issues and to children’s family, community, cultural, and other contexts.

## Diversity, Equity, and Inclusion

* Start science instruction early. Participation in quality science instruction from a young age helps students develop favorable attitudes towards science. To make science accessible to “all” start with 3D science investigations in preschool and continue with them through elementary school and beyond.
* Focus instruction on personal and cultural relevance. Build on the interests, experiences, and desired futures of learners and their communities. This heightens the relevance of science (National Research Council. 2009).
* [Leverage students’ existing design knowledge](https://stemteachingtools.org/assets/landscapes/STEM-Teaching-Tool-39-Everyday-Engineering.pdf). Many elementary school children have engineering design-related hobbies that can be leveraged as they learn science. Engineering design is a great entry-point for many students.

## Recommended Actions You Can Take

* Get into the habit of using the [NGSS Lesson Screener](https://www.nextgenscience.org/sites/default/files/NGSSScreeningTool-2.pdf) when first considering new instructional material. This is an informal review that helps educators to decide if the instructional materials are worthy of an analysis using the [EQuIP Rubric](https://www.nextgenscience.org/resources/equip-rubric-science).
* Become a critical consumer of instructional materials. Before using something, check third-party evaluations. [Ed Reports](https://www.edreports.org/reports/science), the [NextGenScience Peer Review Panel](https://www.nextgenscience.org/peer-review-panel/nextgenscience-peer-review-panel), and the published findings from state education agencies that support statewide instructional materials reviews such as [Oregon](https://www.oregon.gov/ode/educator-resources/teachingcontent/instructional-materials/pages/adopted-instructional-materials.aspx) and [Louisiana](https://www.louisianabelieves.com/resources/library/k-12-science-resources).

## Reflection Questions

* How can we arrange our instruction around interesting phenomena or design projects and use students’ curiosity to engage them in learning science and engineering?
* How can we encourage students to share their own ideas and allow students to build off each other’s ideas to evolve their understanding of science and engineering practices and concepts?
* How can we honor students’ experiences, lived histories, and other assets and connect these experiences during science investigation and engineering design?

## Resources for Additional Professional Learning

* [Why Do We Need to Teach Science in Elementary School?](https://stemteachingtools.org/assets/landscapes/STEM-Teaching-Tool-43-Elementary-Science.pdf)
* [How can teachers guide classroom conversations to support students’ science learning?](https://stemteachingtools.org/assets/landscapes/STEM-Teaching-Tool-48-Guiding-Students-Science-Talk.pdf)
* [Using curriculum adaptation as a strategy to help teachers learn about NGSS and developing aligned instructional materials](https://stemteachingtools.org/assets/landscapes/STEM-Teaching-Tool-5-Curriculum-Adaptation.pdf)

## Bibliography

National Research Council. (2009). *Learning Science in Informal Environments: People, Places, and Pursuits*. Committee on Learning Science in Informal Environments. P. Bell, B. Lewenstein, A.W. Shouse, and M.A. Feder (Eds.). Board on Science Education, Center for Education. Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

National Research Council. 2012. *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*. Washington, DC: The National Academies Press. https://doi.org/10.17226/13165.

National Academies of Sciences, Engineering, and Medicine. 2023. *Rise and Thrive with Science: Teaching PK-5 Science and Engineering.* Washington, DC: The National Academy Press. doi:https://doi.org/10.17226/26853