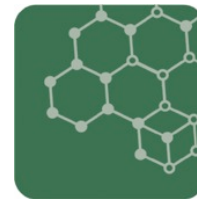
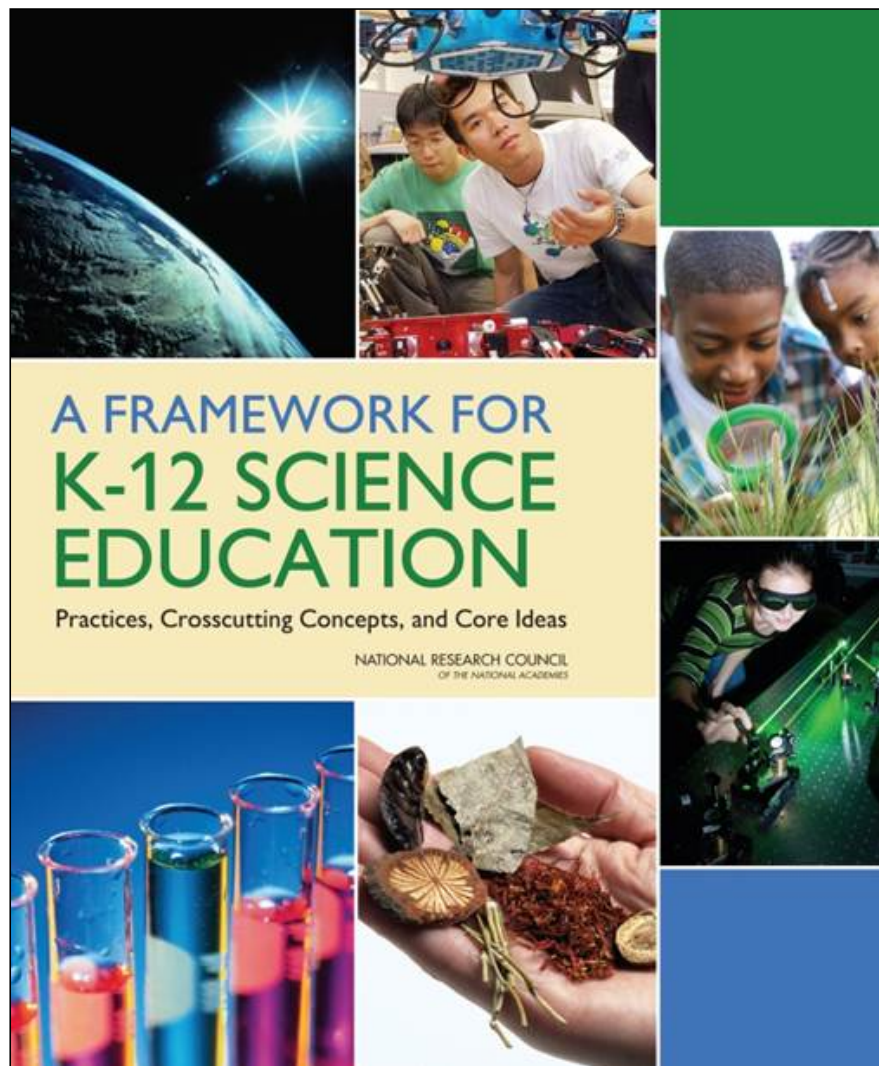


5D... 5 Years Later – Chapter 11

Progress and Next Steps, or: How 5D Science Learning Can Support Equity & Justice

Philip Bell
University of Washington

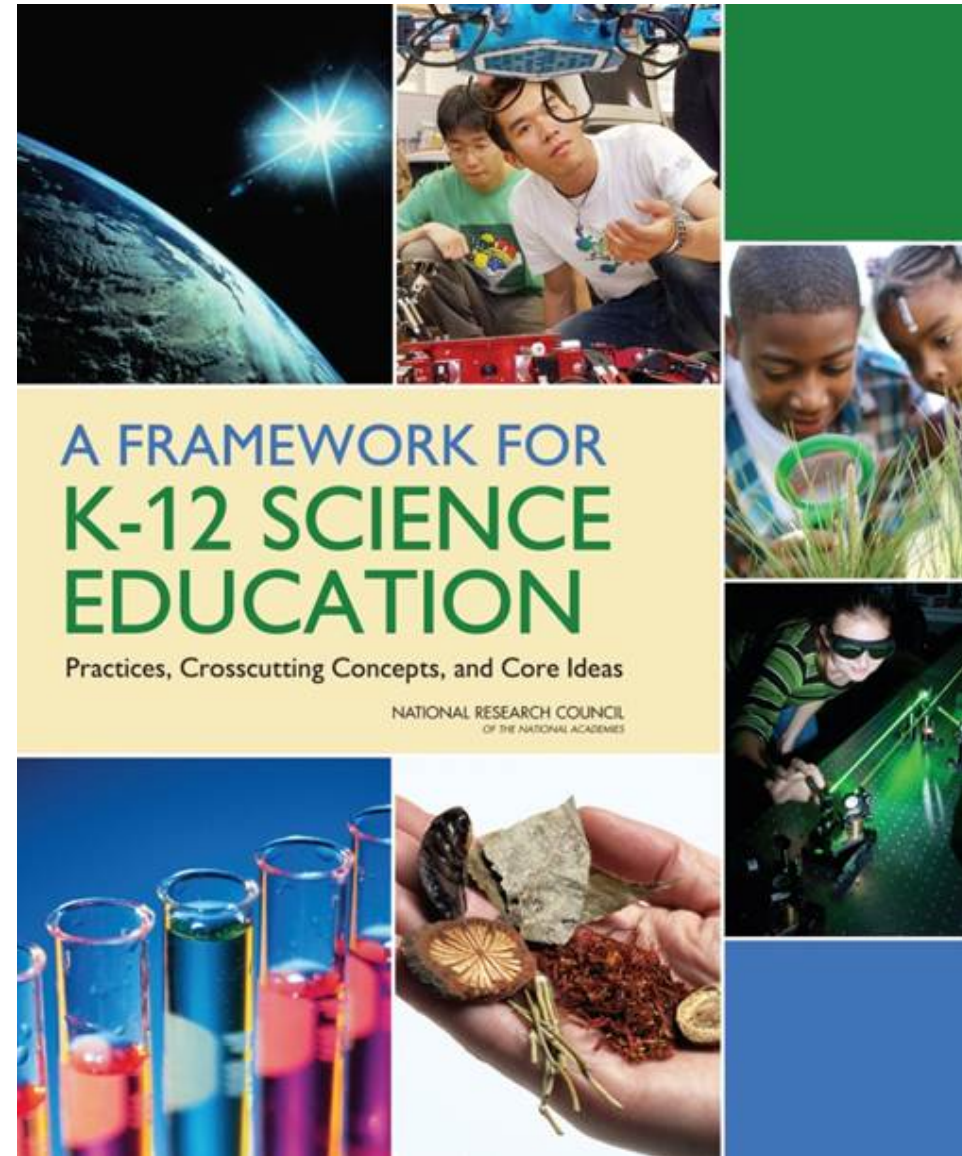


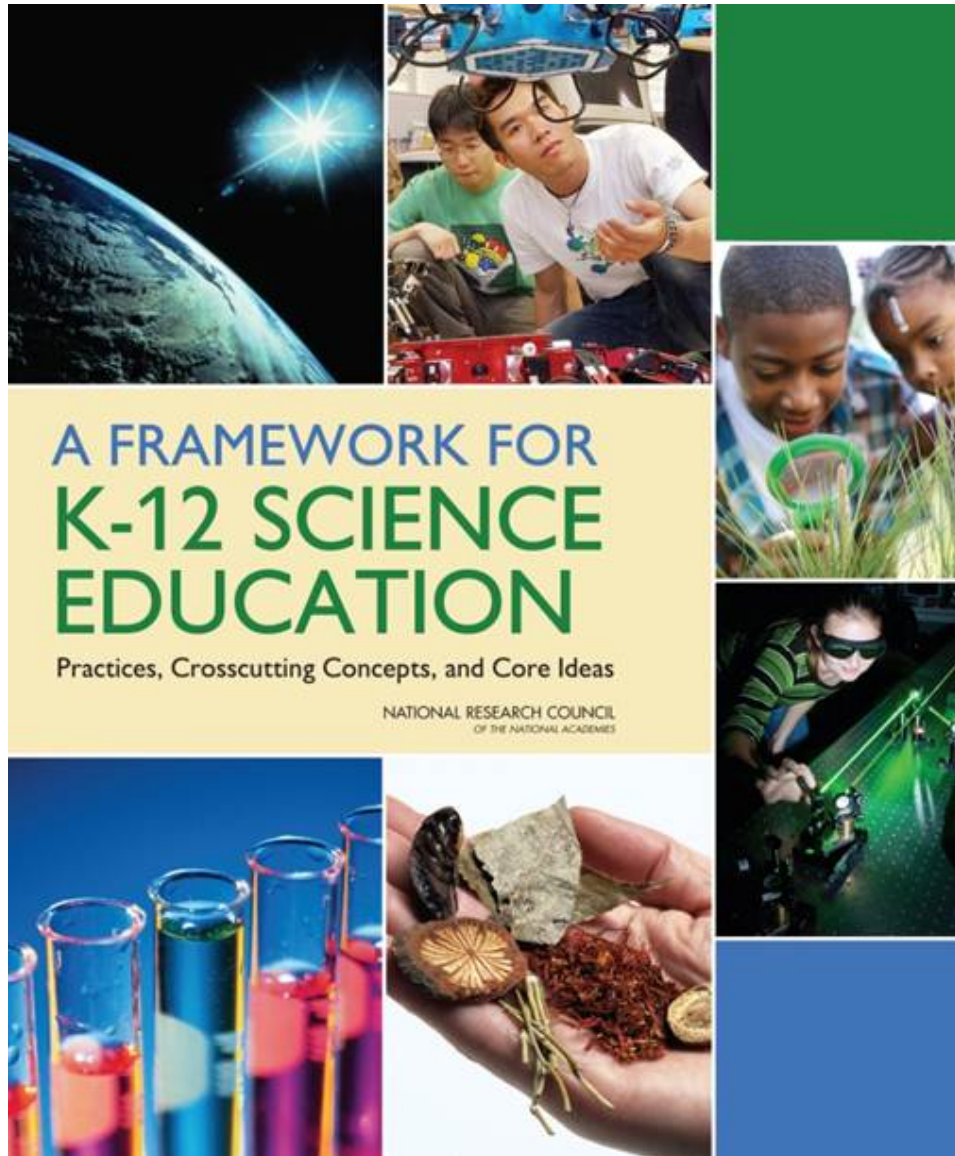


Equity in science education: The work continues...

“Equity in science education requires that *all* students are provided with equitable opportunities to learn science and become **engaged in science and engineering practices**; with **access to quality space, equipment, and teachers** to support and motivate that learning and engagement; and **adequate time spent on science**. In addition, the issue of **connecting to students’ interests and experiences** is particularly important for broadening participation in science.”

— *NRC Framework*, p. 28





Attending to Learner and Community Interests

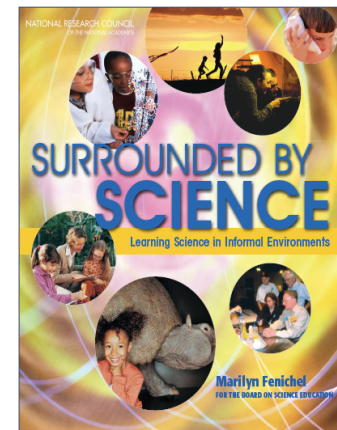
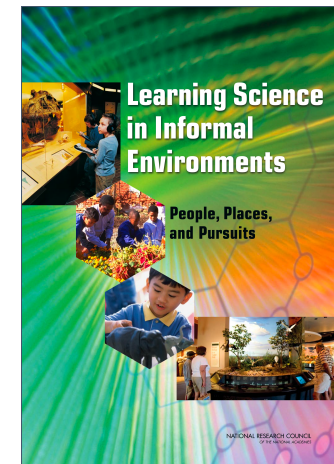
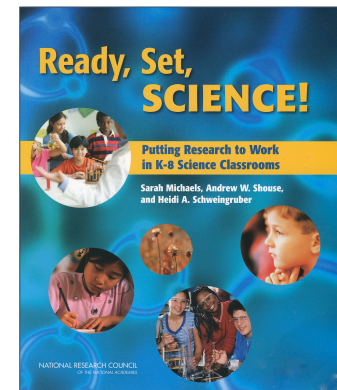
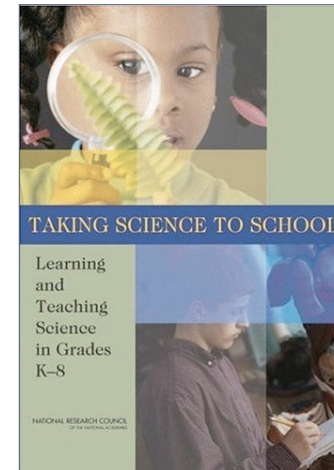
“[A] major goal for science education should be to provide all students with the background to **systematically investigate issues related to their personal and community priorities. They should be able to frame scientific questions pertinent to their interests**, conduct investigations and seek out relevant scientific arguments and data, review and apply those arguments to the situation at hand, and communicate their scientific understanding and arguments to others.”

— *NRC Framework*, (Ch. 11) p. 278

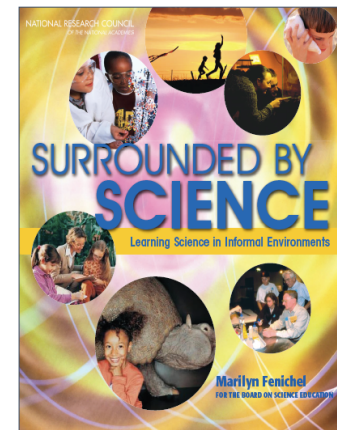
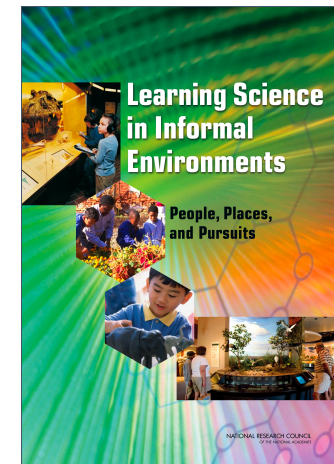
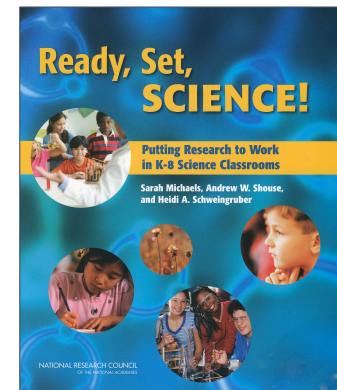
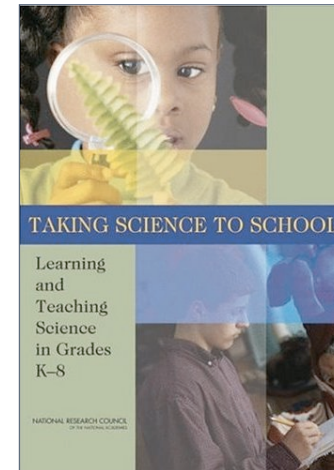
6 Strands of Science Learning

Learners in science learning environments. . .

- 1: Experience excitement, interest, and motivation to learn about phenomena in the natural and physical world.
- 2: Come to generate, understand, remember, and use concepts, explanations, arguments, models and facts related to science.
- 3: Manipulate, test, explore, predict, question, observe, and make sense of the natural and physical world

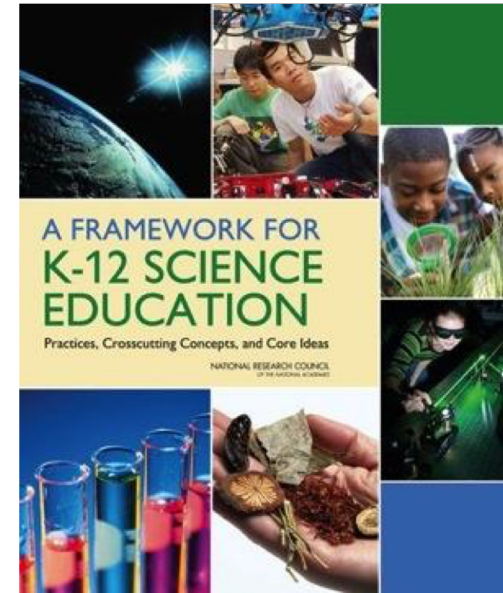


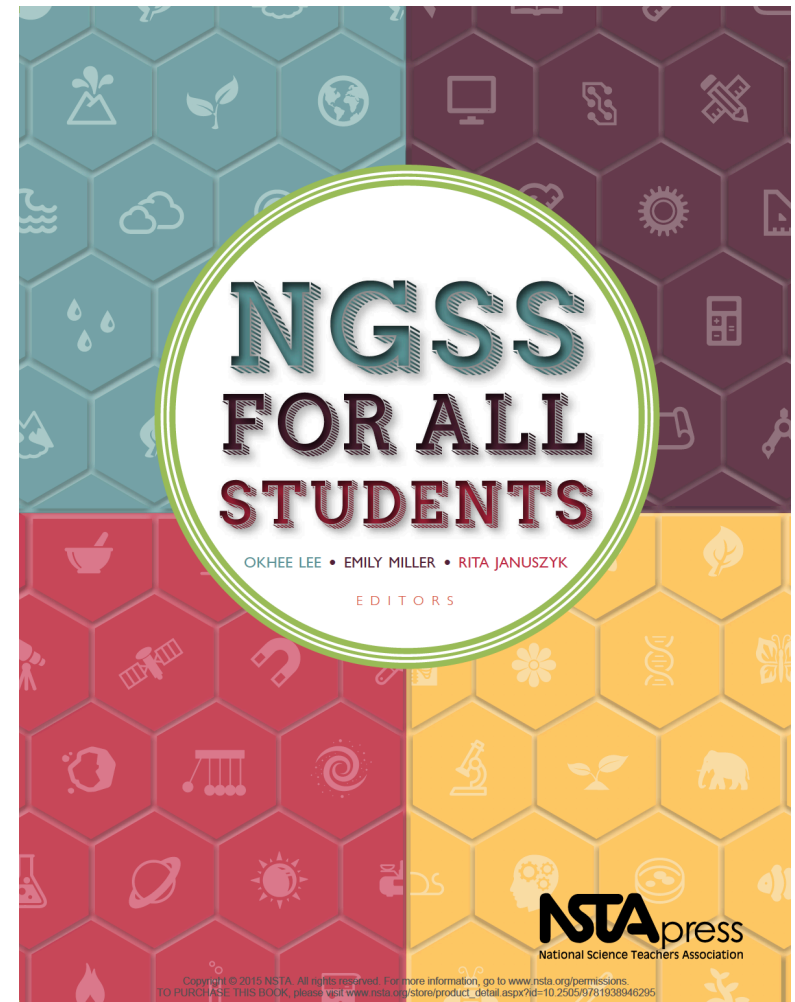
- 4: Reflect on science as a way of knowing; on processes, concepts, and institutions of science, and on their own process of learning about phenomena.
- 5: Participate in scientific activities and learning practices with others, using scientific language and tools.
- 6: Think about themselves as science learners and develop an identity as someone who knows about, uses, and sometimes contributes to science.



Equity & Diversity (NRC Framework Chapter 11)

- Equalizing opportunities to learn
- Inclusive science instruction
 - Science Learning as Cultural Accomplishment
 - Relating Youth Discourses to Scientific Discourses
 - Building on Prior Interest & Identity
 - Leveraging Students' Cultural Funds of Knowledge
- Making diversity visible
- Value multiple modes of expression







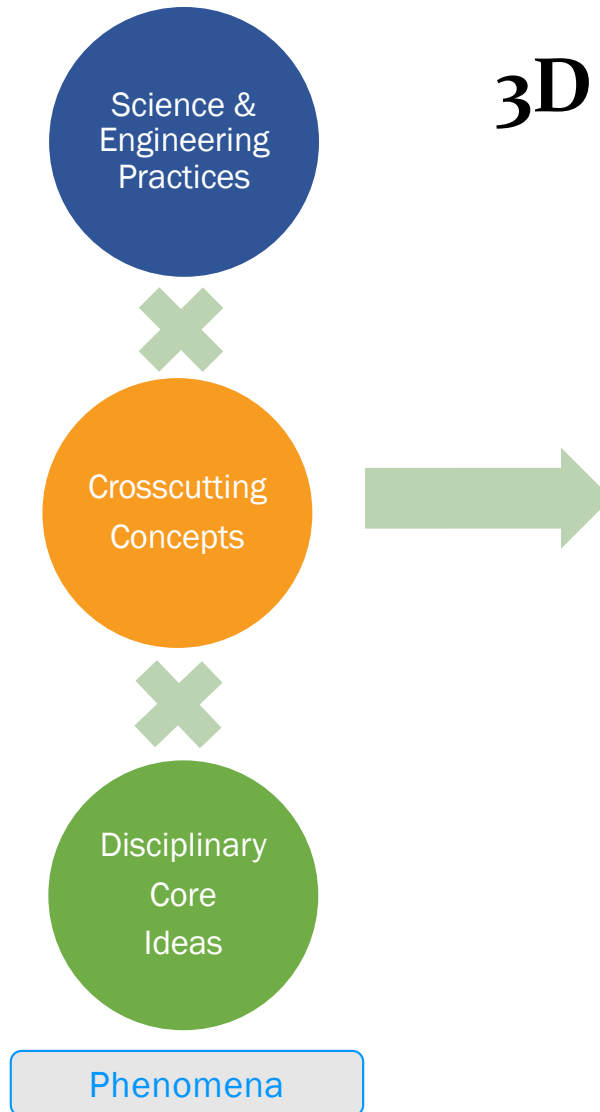
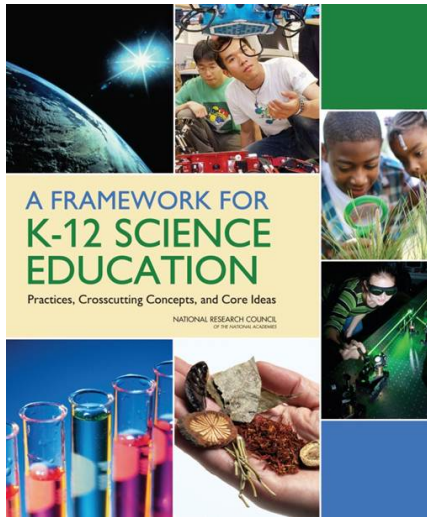
STEM
TEACHING TOOL
#10

Teaching STEM In Ways that
Respect and Build Upon Indigenous
Peoples' Rights



STEM
TEACHING TOOL
#11

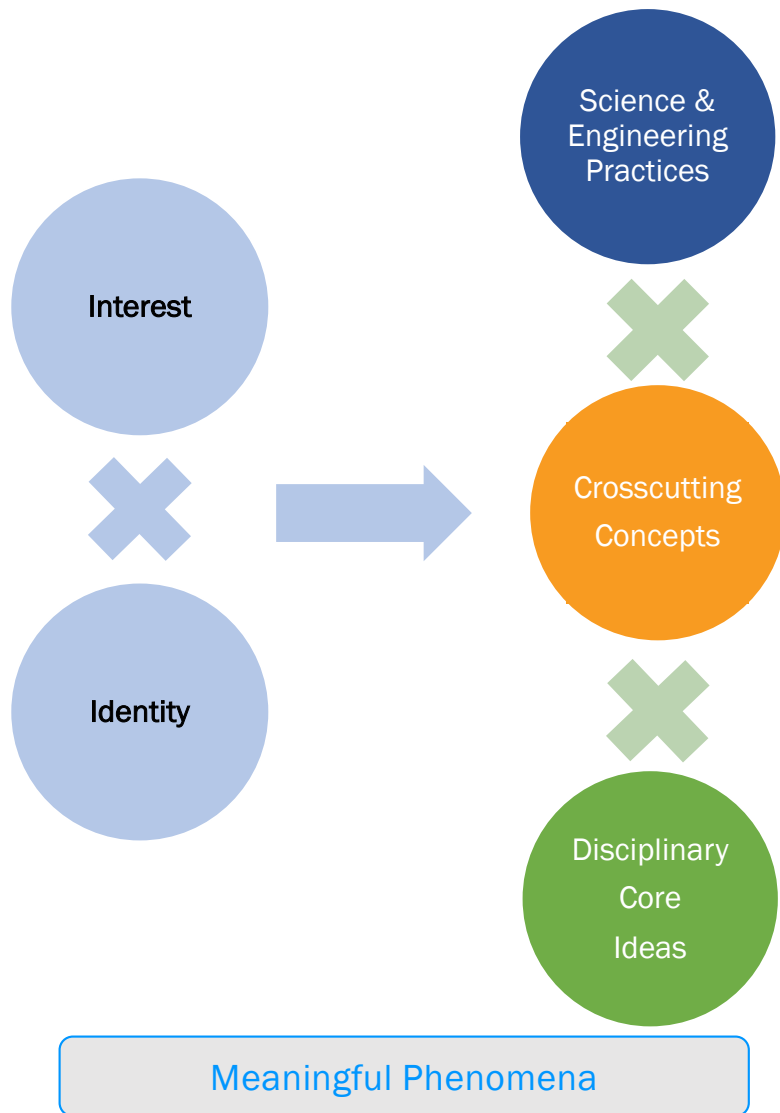
Implementing Meaningful STEM
Education with Indigenous Students &
Families



3D Learning is Powerful



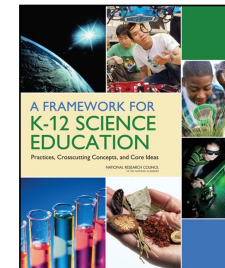
Students learn to ‘figure out’ how to explain and model phenomena—and to design solutions



We actually need 5D Learning!

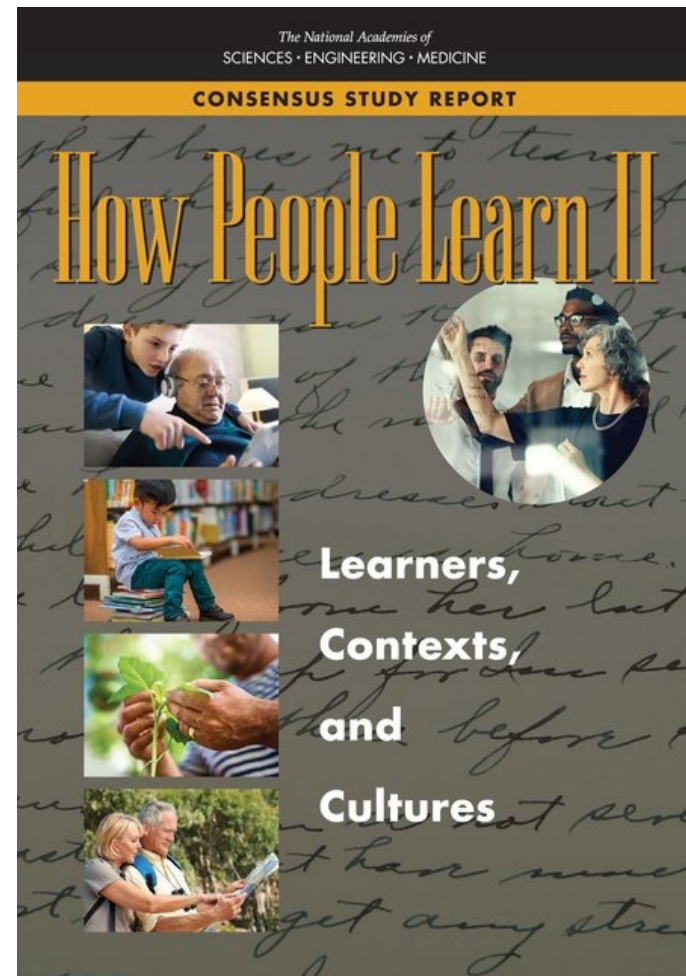
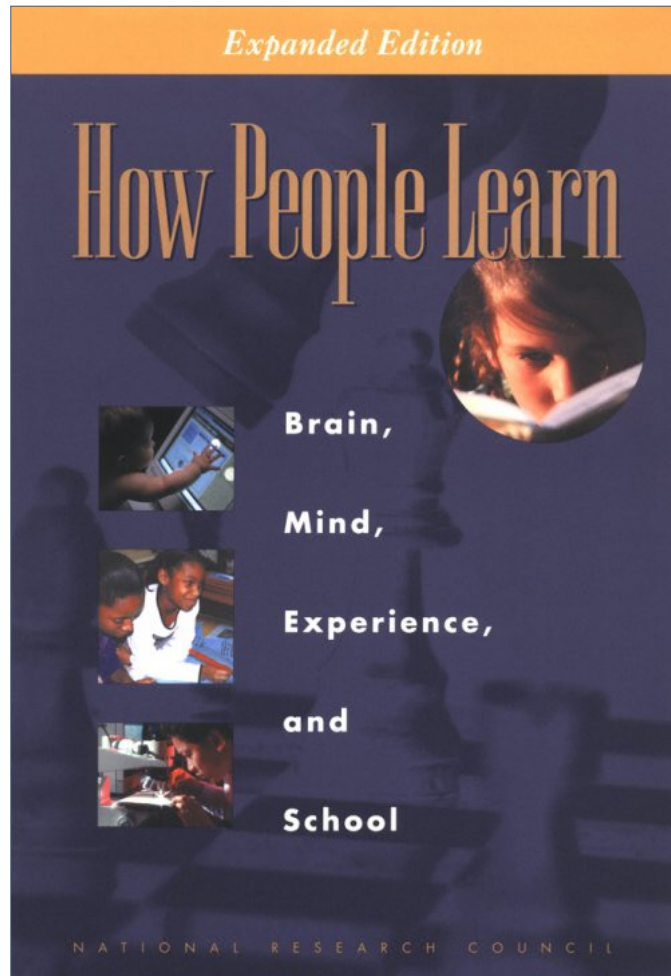


For Meaningful Experiences



Building on Learners' Prior Interest & Identity is Key

Orient teaching and learning toward equity and justice goals



Free PDFs available at nap.edu

Alberto Rodriquez (2015) responded suggesting a fourth engagement, equity & diversity dimension.

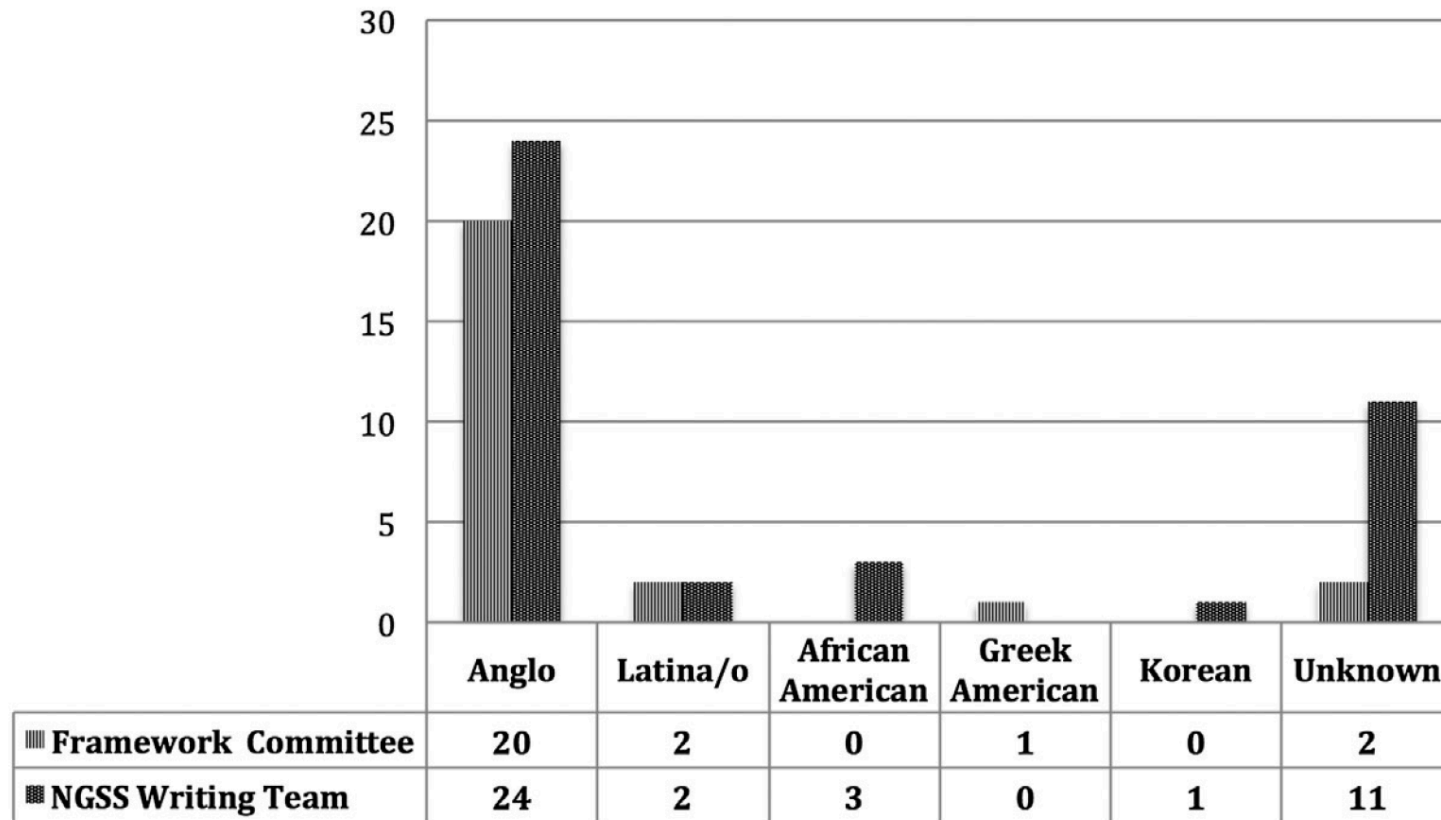
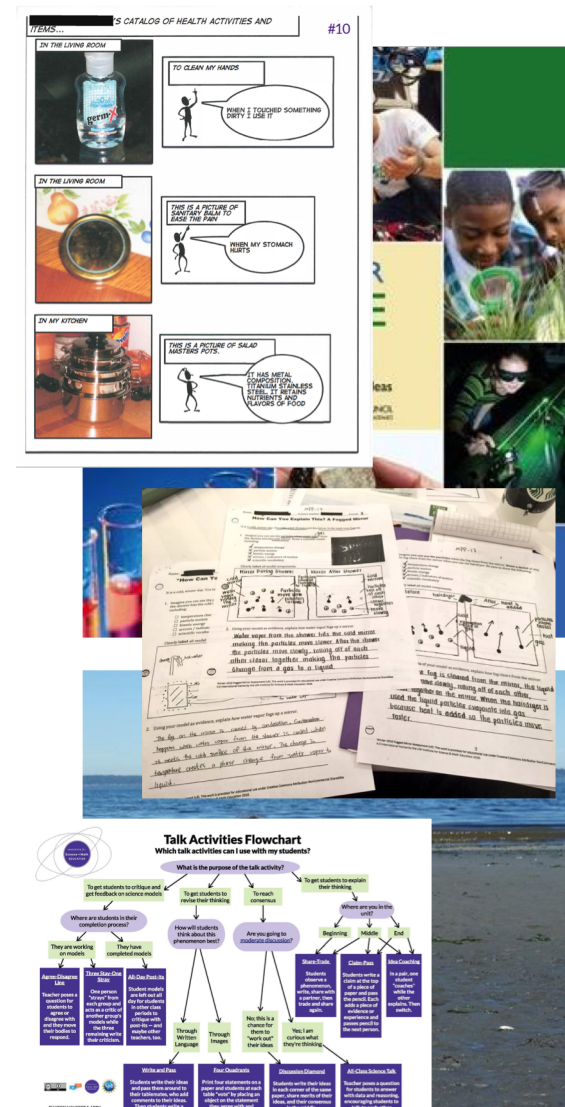


Figure 1. Committee members' ethnicities.

Rodriguez, A. (2015). What about a Dimension of Engagement, Equity, and Diversity Practices? A Critique of the Next Generation Science Standards, *Journal of Research in Science Teaching*.

Equitable Science Instruction from NRC Framework Chapter 11

1. Learning is cultural. Instruction should grow out of **everyday experience** of learners and connect to their **interests and identities**.
2. Instruction should **leverage science-related values, knowledge, and practices** of students, their families, and cultural communities.
3. Instruction should allow students to leverage their **full communicative resources** during sensemaking.



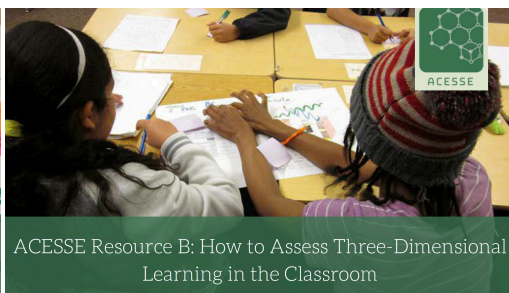
Building Capacity for State Science Education (BCSSE)

Developing Tools and Resources for Communicating the Messages of the Framework

- The message in the Framework is a coherent vision for science teaching and learning
- Understanding this message is powerful and meaningful to change science education
- Building this message is an important step in the process of implementing new standards
- The messages must be consistent with the Framework to move the endeavor forward



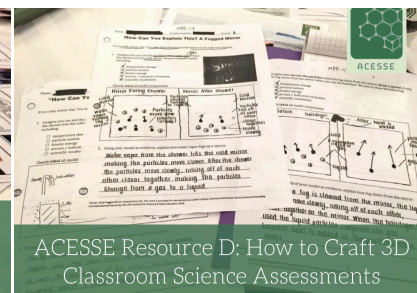
ACESSE Resource A: Introduction to Formative Assessment to Support Equitable 3D Instruction



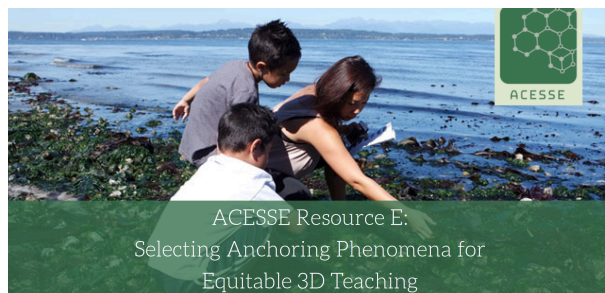
ACESSE Resource B: How to Assess Three-Dimensional Learning in the Classroom



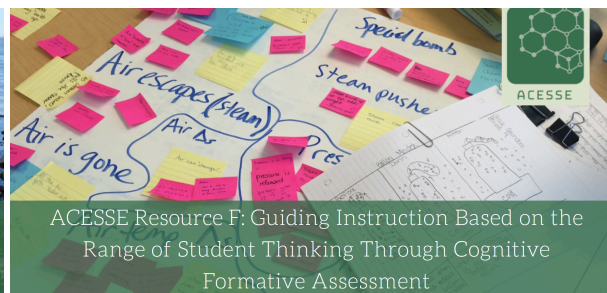
ACESSE Resource C: Making Science Instruction Compelling for All Students: Using Cultural Formative Assessment to Build on Learner Interest and Experience



ACESSE Resource D: How to Craft 3D Classroom Science Assessments



ACESSE Resource E: Selecting Anchoring Phenomena for Equitable 3D Teaching



ACESSE Resource F: Guiding Instruction Based on the Range of Student Thinking Through Cognitive Formative Assessment



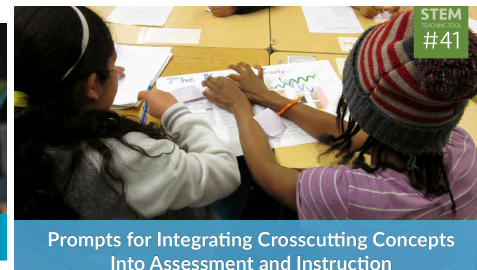
ACESSE Resource G: Learning to See the Resources Students Bring to Sense-Making



Steps to Designing a Three Dimensional Assessment



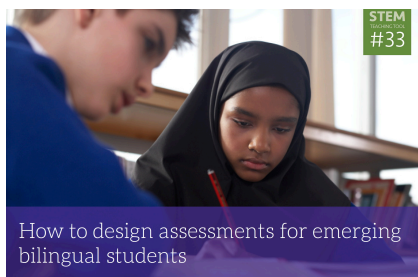
Integrating Science Practices Into Assessment Tasks



Prompts for Integrating Crosscutting Concepts Into Assessment and Instruction



How to build an equitable learning community in your science classroom



How to design assessments for emerging bilingual students



Beyond “misconceptions”: How to recognize and build on Facets of student thinking



Qualities of a good anchor phenomenon for a coherent sequence of science lessons



How can I promote equitable sensemaking by setting expectations for multiple perspectives?

“That’s interesting, but it isn’t really
central to the vision.” (~2013)

“Aren’t we done talking about equity yet?” (~2017)

“If you have come to help me,
you are wasting your time.
But if you have come because your
liberation is bound up with mine,
then let us walk together...”

— *Lila Watson, Indigenous Australian /
Murri visual artist, activist, and academic*



Position Statement on Equity and Access to Science Education Council of State Science Supervisors

“The Council of State Science Supervisors, through its state level work, is committed to the equity vision of *A Framework for K-12 Science Education* and seeks to embrace and leverage students’ cultures and identities as primary drivers in their science education. An equitable education system ensures that *all students are known, heard and supported* while having access and opportunities to the resources they need to learn, live and make meaningful contributions to their communities.”

Equity & Justice **Goals** for Science & STEM Ed

1	Increased representation & broadened participation in STEM
2	Increased student achievement in science—often starts & sometimes ends with opportunity & access when we need belonging & identification, perhaps uses logic of ‘sameness’ when culture-based pedagogy is needed
3	Problematize the privileged forms of science—work to expand ‘what counts as science,’ ‘who does science,’ ‘when is science’; support diverse sense-making
4	Focus science learning on youth & community purposes—youth & community agency is centered; accountability shifts to personal & community goal attainment
5	Leverage science in social and multi-species justice movements—prioritizes science as a tool in community organizing and social movements, requires critical view of historical inequity

Adapted from Philip & Azevedo, *Science Education*, 2017 by Philip Bell