

UNIVERSITY of WASHINGTON

*All young people should be able to decide their futures.*



## Promoting equity and justice through science standards implementation

Philip Bell

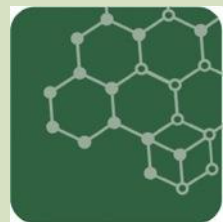
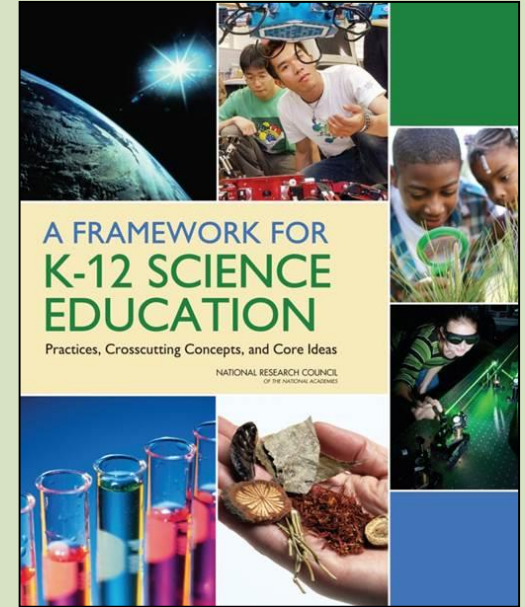
*Learning Sciences & Human Development, UW*

Ellen Ebert

*Office of Superintendent of Public Instruction (OSPI)*

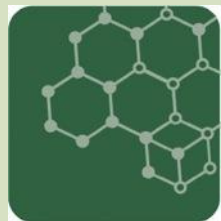
“All science learning can be understood as a cultural accomplishment....What counts as learning and what types of knowledge are seen as important are closely tied to a community’s values and what is useful in that community context.”

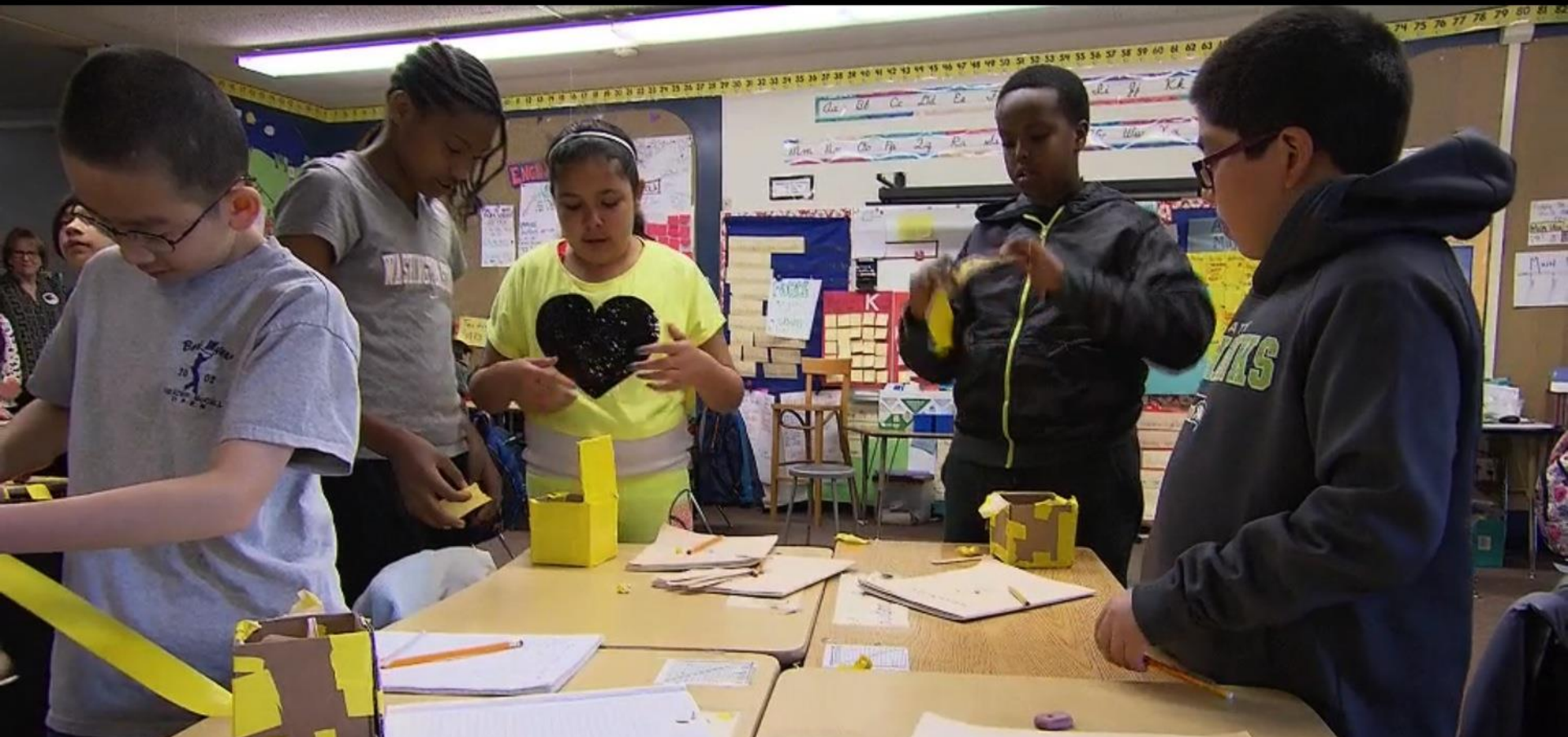
— NRC, 2012, p. 284



# How can science instruction...

- be inclusive to the interests and goals of all students and their communities?
- connect the science students learn in class to experiences outside the classroom—in personally or culturally relevant ways?
- build on student's experiences with natural phenomena?
- make connections between everyday and disciplinary knowledge, discourse, and ways of knowing?
- help students leverage or extend personal identities in relation to science?

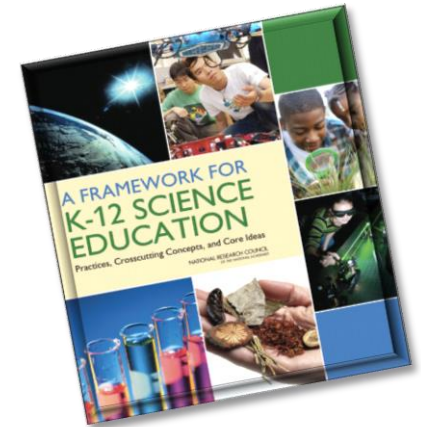




**Students learn science best by engaging in science and engineering practices as part of sustained investigations. In the process, they make sense of disciplinary core ideas and cross-cutting concepts.**

# Principles of *A Framework for K-12 Science Education*

- Children are born investigators
- Understanding builds over time
- Science and Engineering require both knowledge and practice
- Connecting to students' interests and experiences is essential
- Instruction focuses on core ideas and practices
- Science learning standards promote equity

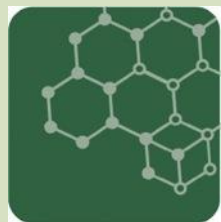


Equity-oriented STEM education must promote a **rightful presence** for all students across the scales of justice.

— Calabrese Barton

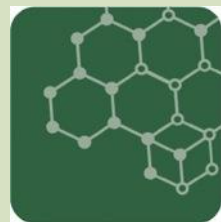
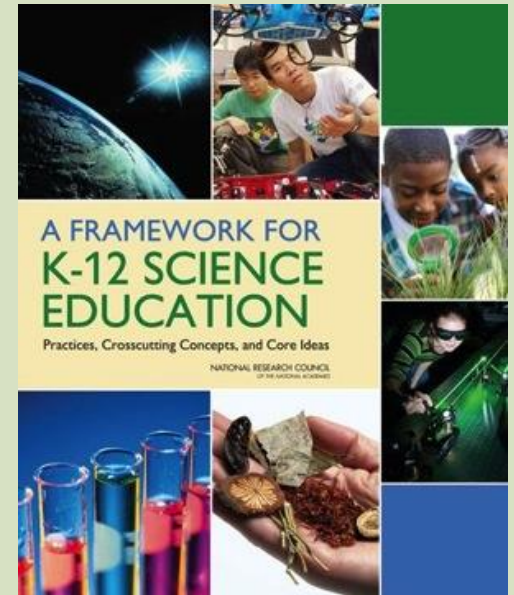
Progress frequently involves **de-settling** systems associated with historical inequities (Bang, et al., 2012) — while imagining and resourcing expansive **cultural learning pathways**

(Bell, et al., 2012).



# Equity & Diversity (NRC Framework Chapter 11)

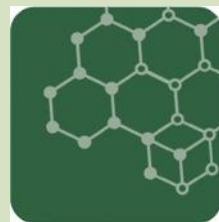
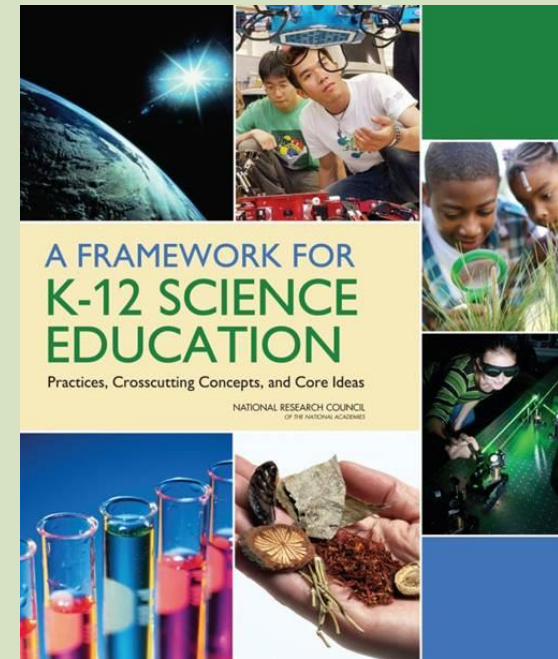
- Equalizing opportunities to learn
- Inclusive science instruction
  - Science Learning as Cultural Accomplishment
  - Relating Youth Discourses to Scientific Discourses
  - Building on Prior Interest & Identity
  - Leveraging Students' Cultural Funds of Knowledge
- Making diversity visible
- Value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



# Building on Prior Interest & Identity

“Learning science depends not only on the accumulation of facts and concepts but also on the development of an identity as a competent learner of science with motivation and interest to learn more.”

— *NRC Framework*, p. 287

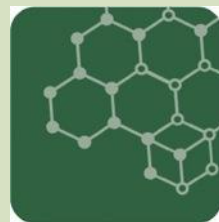
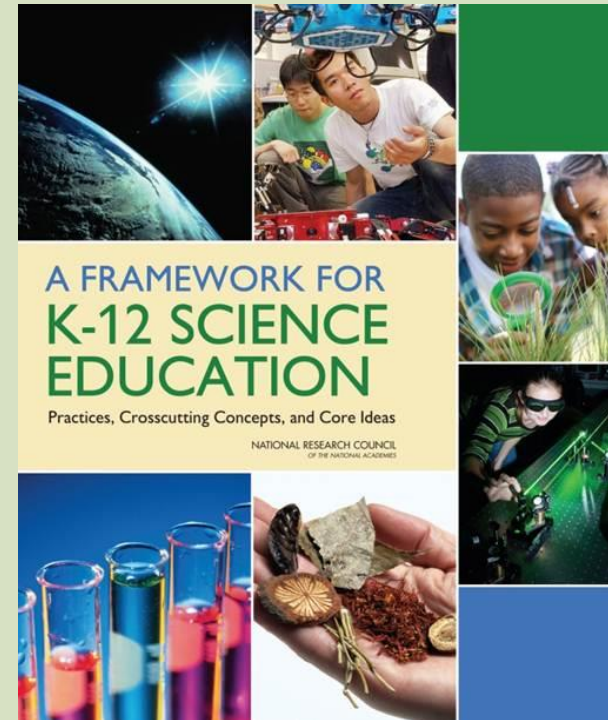




# Building on Prior Interest & Identity

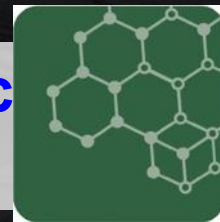
“Instruction that builds on prior interest and identity is likely to be as important as instruction that builds on knowledge alone. All students can profit from this approach, but the benefits are particularly salient for those who would feel disenfranchised or disconnected from science should instruction neglect their personal inclinations.”

— *NRC Framework*, p. 287

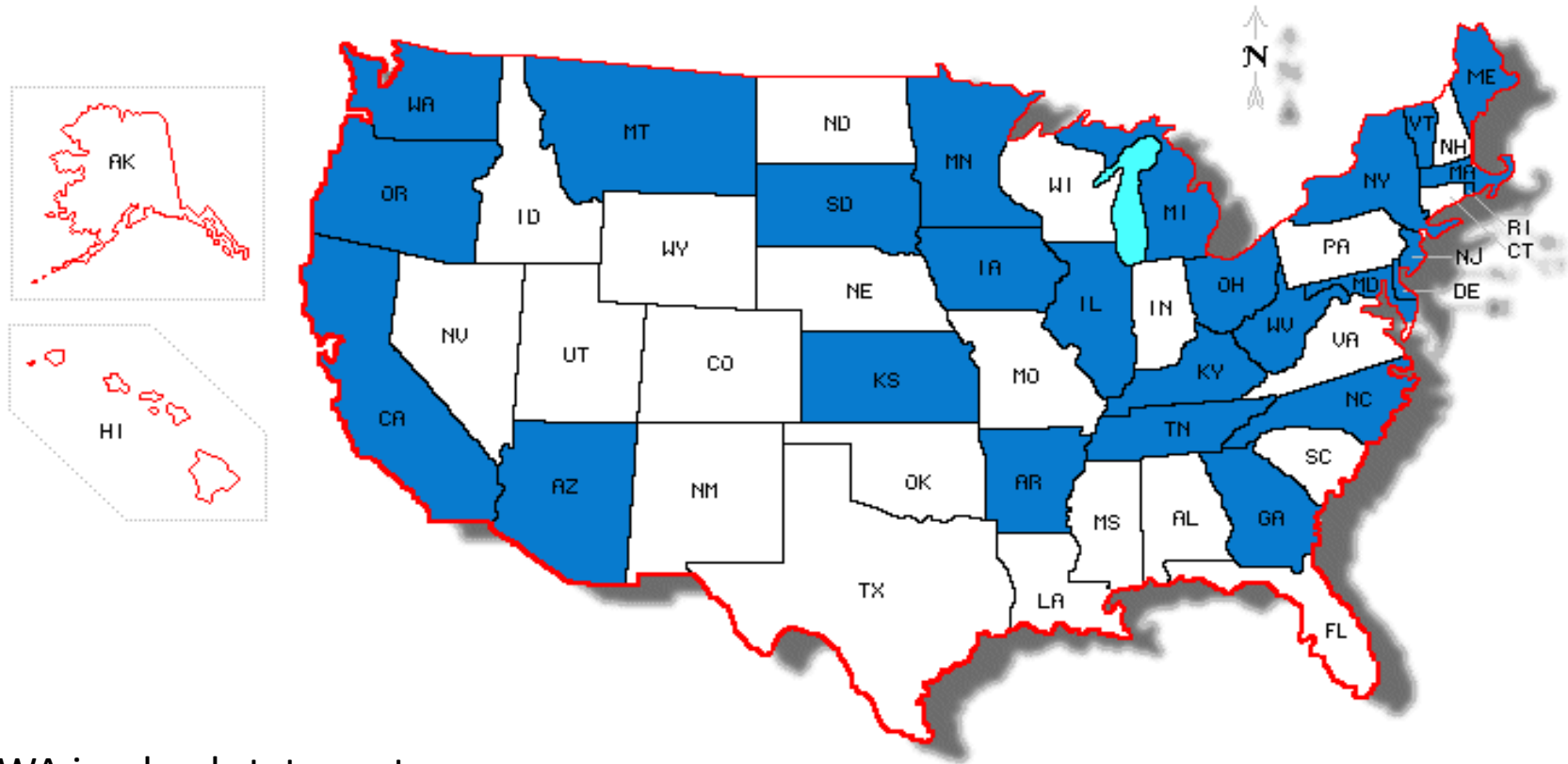




# Investigating Contemporary Genetics: Using DNA Barcoding to Identify an Unknown Species



# NGSS “Lead” States (2011-present)



WA is a lead state partner

2 writers

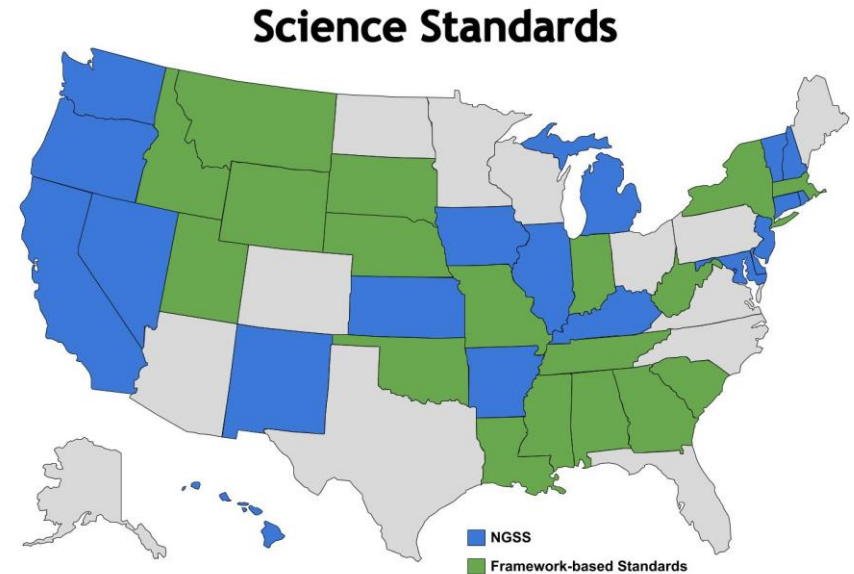
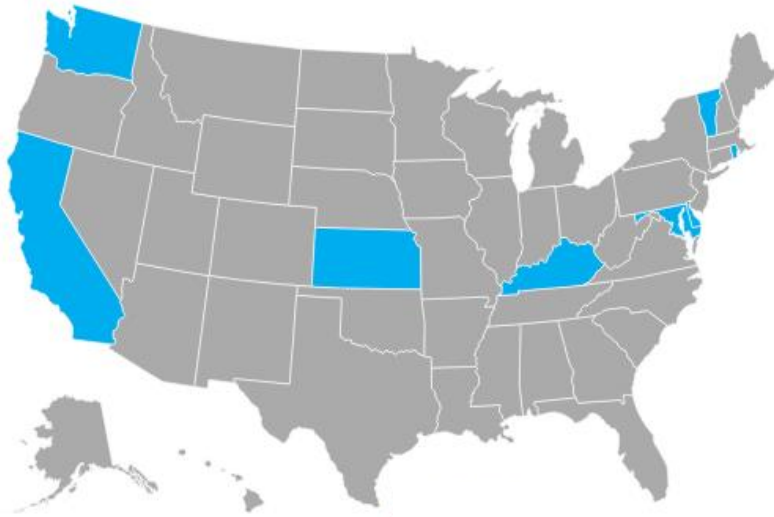
>1000 reviewers during Public Draft Release





# States Adopting Next Generation Science Standards

As of October 4, 2013

As of November, 2017



-  No action yet
-  States that have adopted standards

Washington milestones:

Transition plan in year 5; 300 Statewide Science Fellows; NSF funded ACESSE Grant State Participant; NSF funded NextGen STEM Teacher Preparation Grant



# Cultural Formative Assessment



Focus is on ways of knowing, doing, and being that are specific to science and other subjects. It presumes that students bring to the learning environment important knowledge, interests, and experiences from their daily lives that teachers must elicit and use to inform instruction.



# Mini Activity: Surfacing cultural health practices through self-documentation

CAITLIN YANG'S CATALOG OF HEALTH ACTIVITIES AND ITEMS...

IN THE KITCHEN



MY FAMILY DRINKS TEA



WE THINK DRINKING TEA IS  
HEALTHY

IN THE BATHROOM



WASHING HANDS



WASHING HANDS  
HELP KEEP GERMS  
AWAY

IN THE BACKYARD



WE EAT VEGETABLES EVERY DAY



EATING VEGETABLES IS  
HEALTHY THAT'S WHAT  
MOM SAYS

- Use community health practices to guide instruction
- Self-documentation technique used to bridge community activities with school inquiry and sense-making

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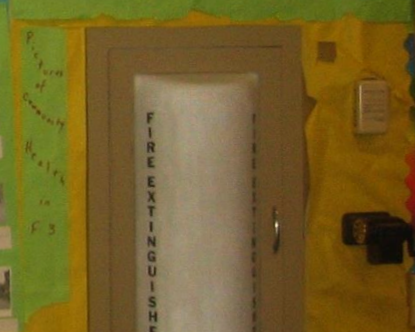
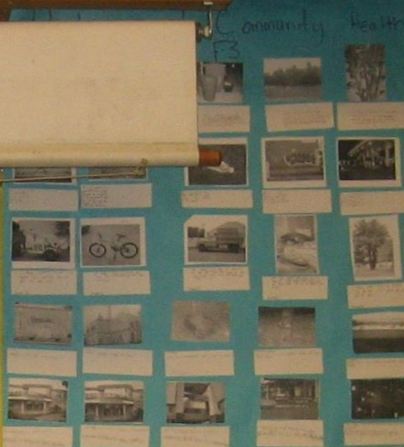


To  
CRIME!

### Community Health Issues (That involve Micros)

- \* littering
- \* Smoking / Stand hand
- obesity
- \* recycling
- smoke
- \* addicted to pain medicine
- \* burning coal
- \* car pollution
- \* hygiene
- \* illegal drug use
- \* share things you are not supposed to share
- \* kick out exercising
- alcoholism
- \* eating vitamins
- \* cutting down trees
- eating junk food
- \* turning to street when sick
- \* washing hand
- \* handling mud
- \* nonsterile sites
- \* drinking water
- \* access to healthy food
- over consumption
- \* I got ear infections
- landfills (where they are)

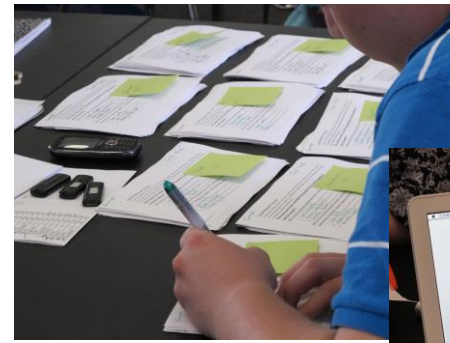
### Pictures of Community Health in F2



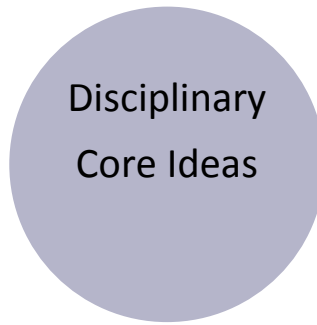
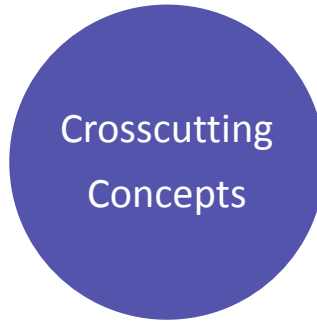
FIRE EXTINGUISHER



**Learning  
Conceptualized  
along Three  
Dimensions**



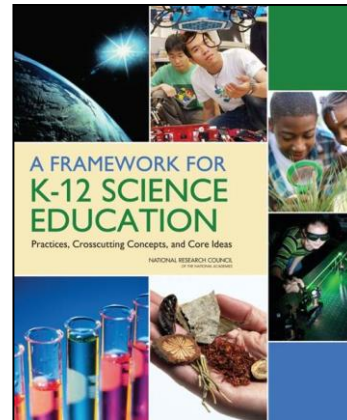
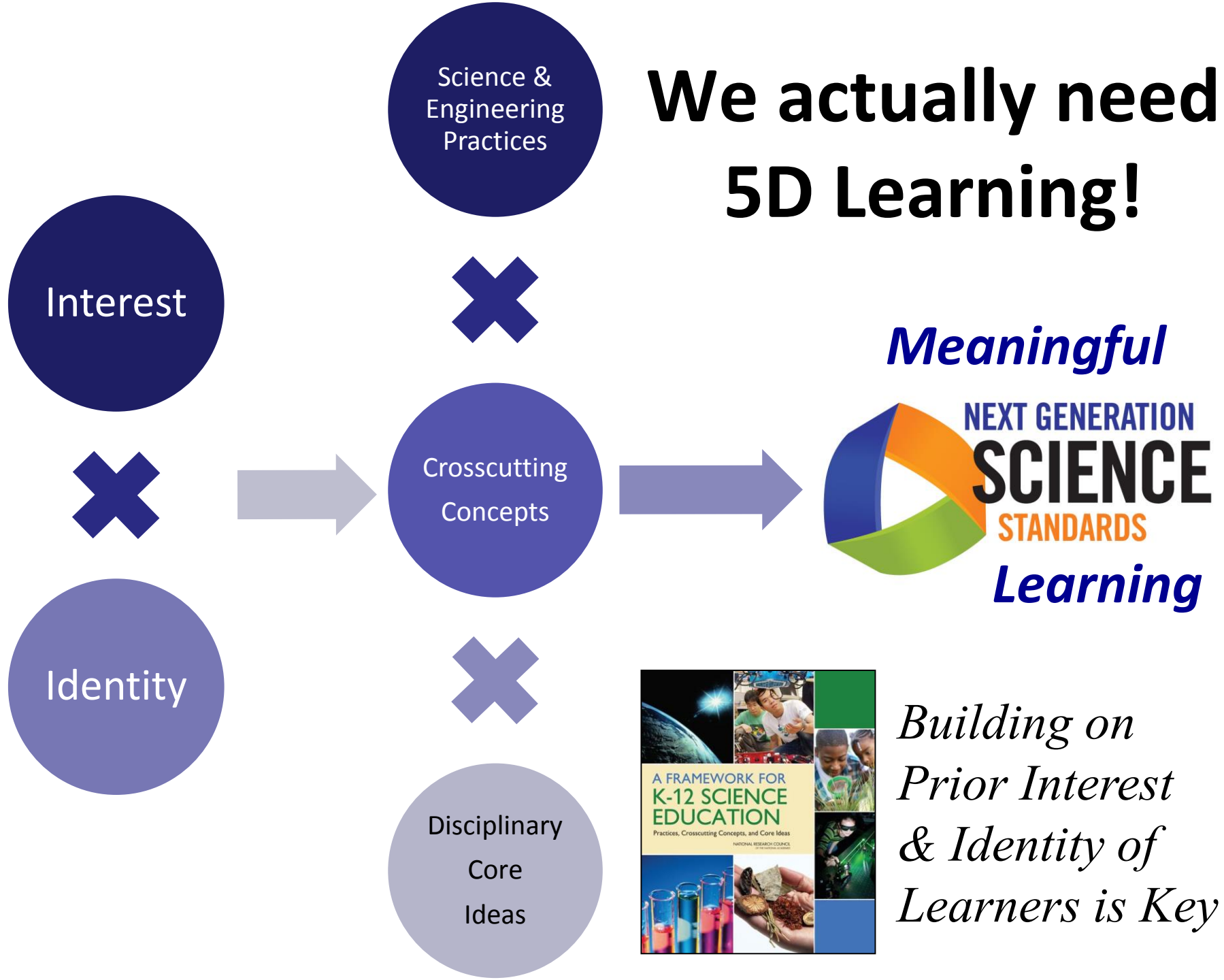
**Guided  
Development  
of New  
Educational  
Standards**



*Standards take the form of performance expectations defined through combinations of elements of the three dimensions that progress across grade levels*



# We actually need 5D Learning!



*Building on  
Prior Interest  
& Identity of  
Learners is Key*

# Different Science Education Equity Goals to Work Towards

- 1. Emphasize increased student achievement of science**—often starts (and sometimes ends) with access, perhaps assumes ‘sameness’
- 2. Problematize the privileged forms of science**—work to expand *what counts as science, who does science, when is science*
- 3. Focus science learning on youth & community purposes**—youth & community agency is centered; accountability shifts to personal & community goals
- 4. Leverage science in justice movements**—prioritizes science as a tool in community organizing and social movements





# Assessment of Student Thinking



# Professional Learning Resources to Support STEM Ed Improvement



Using curriculum adaptation as a strategy to help teachers learn about NGSS and developing aligned instructional materials

## What Is The Issue

Using curriculum materials aligned to NGSS is a crucial part of implementation, but there is very little aligned curricula to choose from, districts may not have resources to purchase it, and teachers typically don't have time to develop new curriculum from scratch. However, teachers can effectively adapt existing curriculum materials and instruction to better align with NGSS. This can help them learn about important parts of the NGSS vision for learning—and result in instructional materials for use across classrooms.

## WHY IT MATTERS TO YOU

- Teachers should analyze and adapt tasks in existing curriculum to support student engagement in the science and engineering practices.
- District staff and PD providers should learn about how to support networks of teachers to engage in curriculum adaptation and share the resulting instructional materials.
- School leaders should support efforts to engage teachers in adapting, testing, and refining enhancements of currently-adopted curriculum materials.

BY TAMMY COOK-EMMEL, ALEXIA TAYLOR & BILL PERKINS | JULY 2016

[STEMteachingtools.org/brief5](http://STEMteachingtools.org/brief5)



Overview: How can we promote equity in science education?

## What Is The Issue?

Equity should be prioritized as a central component in all educational improvement efforts. All students can and should learn complex science. However, achieving equity and social justice in science education is an ongoing challenge. Students from non-dominant communities often face "opportunity gaps" in their educational experience. Inclusive approaches to science instruction can reposition youth as meaningful participants in science learning and recognize their science-related assets and those of their communities.

## WHY IT MATTERS TO YOU

- Teachers should work with colleagues to implement instructional strategies to make science learning experiences more inclusive for all students.
- District staff and PD providers should integrate a focus on equity and social justice into every teacher learning experience in relevant ways—and not treat diversity as a segregated topic.
- School leaders should promote a sustained focus on inclusive science instruction. Efforts should be made to resource and monitor equitable opportunities to learn science.

BY PHILIP BELL AND MEGAN BANG | JANUARY 2015

[STEMteachingtools.org/brief15](http://STEMteachingtools.org/brief15)

- *Co-designed by educators & researchers*
- *Tested & refined over time*
- *Easily shareable—over social media, email, paper*



Implementing Meaningful STEM Education with Indigenous Students & Families

## What Is The Issue?

Indigenous ways of knowing are often perceived to be contrary to STEM learning, but they are in fact powerful resources for learning. STEM instruction should be made inclusive for Indigenous students by building connections between Indigenous and Western STEM. There are a set of strategies teachers can use to intentionally incorporate indigenous ways of knowing into STEM learning environments—both in and out of school and in relation to family and community.

## WHY IT MATTERS TO YOU

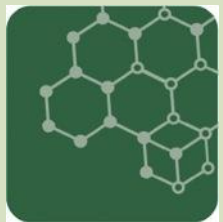
- Teachers should focus on Indigenous ways of knowing & encourage Indigenous students to navigate between Indigenous & Western STEM.
- District staff and PD providers should build relationships with Indigenous communities they serve and focus PD on Indigenous STEM, including relations to land.
- School leaders need to recognize what it looks like for Indigenous students to learn western & Indigenous STEM and ensure approaches are adopted.

BY MARISSA SPRING & MEGAN BANG | NOVEMBER 2014

[STEMteachingtools.org/brief11](http://STEMteachingtools.org/brief11)

**STEMteachingtools.org (web)**  
**@STEMteachtools (twitter)**  
**facebook.com/STEMTeachingTools**

For discussion if time





Advancing  
Coherent and  
Equitable  
Systems of  
Science  
Education  
(ACESSE)



# Three principles towards more equitable learning in science



**Principle 1: Notice sense-making repertoires.** Consider students' diverse sense-making as connecting to science practices.



**Principle 2: Support sense-making.** Support students to use their sense-making repertoires and experiences as critical tools in engaging with science practices.



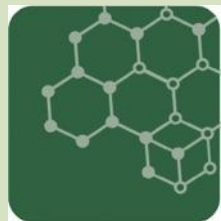
**Principle 3: Engage diverse sense-making.** Students' scientific practices and knowledge are always developing and their community histories, values, and practices contribute to scientific understanding and problem solving.

From: Bang, Brown, Calabrese Barton, Rosebery & Warren, Toward more equitable learning in science, In *Helping students make sense of the world using next generation science and engineering practices*, NSTA.

# Work on **Concrete Equity Projects** That Matter in Your Community

focusing instruction on Indigenous ways of knowing	supporting ELL students (e.g., with translanguaging)	identifying meaningful science phenomena
engaging all girls in science	debunking adverse stereotypes about who can do science	minimizing social injuries in the classroom
coordinate learning across formal and informal education	building capacity for formative assessment	expanding 'what counts' as science

And many others...





# Equitable Science Instruction

