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
“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
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

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

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

Meaningful 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

Adapted from Philip & Azevedo, *Science Education*, 2017
Assessment of Student Thinking
Professional Learning Resources to Support STEM Ed Improvement

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

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**

<table>
<thead>
<tr>
<th>Focusing instruction on Indigenous ways of knowing</th>
<th>Supporting ELL students (e.g., with translanguaging)</th>
<th>Identifying meaningful science phenomena</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engaging all girls in science</td>
<td>Debunking adverse stereotypes about who can do science</td>
<td>Minimizing social injuries in the classroom</td>
</tr>
<tr>
<td>Coordinate learning across formal and informal education</td>
<td>Building capacity for formative assessment</td>
<td>Expanding ‘what counts’ as science</td>
</tr>
</tbody>
</table>

And many others...
Equitable Science Instruction

- Minimize epistemic injury
- Learning is cultural
- Broaden what counts as STEM
- Position learners as developing experts
- Support multiple ways of knowing