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

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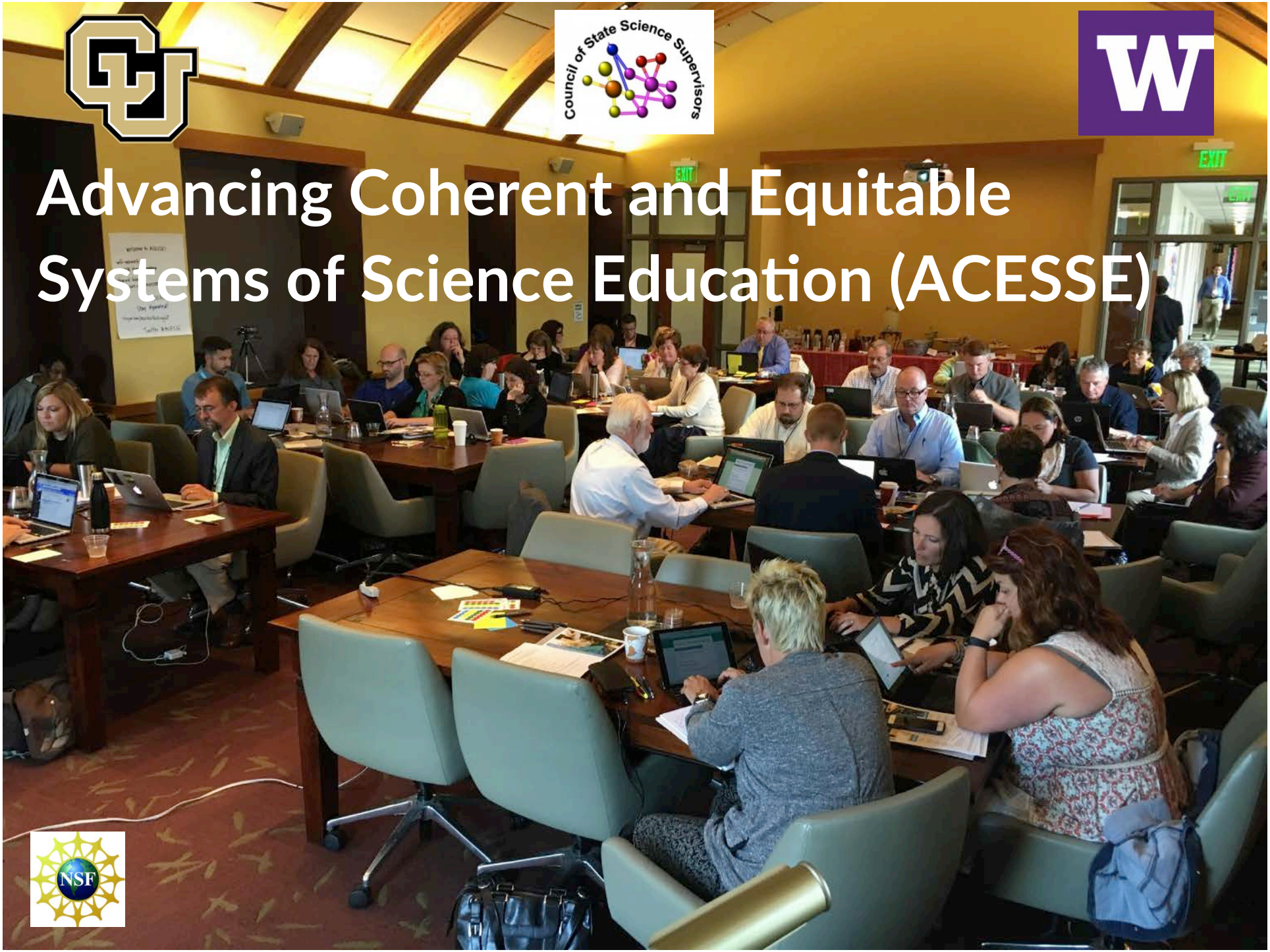
With contributions from Shelley Stromholt, Tiffany Neill, Sam Shaw, Lizette Burks, Bill Penuel, Robbin Riedy, Kris Kilibarda, and Megan Schrauben.

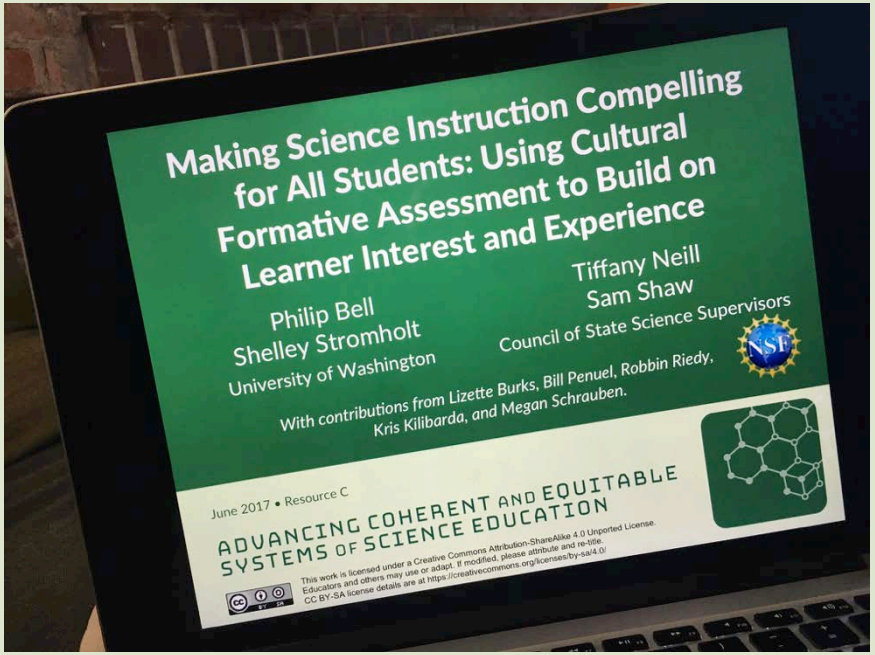
January 2018 • Adaptation of ACESSE Resource C

ADVANCING COHERENT AND EQUITABLE SYSTEMS OF SCIENCE EDUCATION



Advancing Coherent and Equitable Systems of Science Education (ACESSE)

ACESSE Resource C



Overview: Participants learn how to design formative assessments that build on learners' interest and experience, promoting equity and social justice in the process.

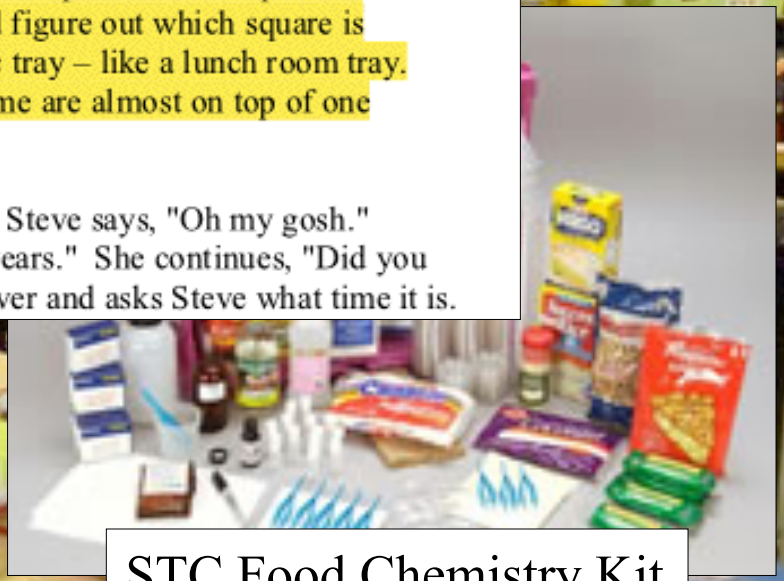
stemteachingtools.org/pd/SessionC

Introduce yourself over chat. Please include your name, school / organization, and one hobby that you have engaged in for *at least 10 years*.


ALL YOUNG PEOPLE SHOULD HAVE ACCESS TO QUALITY STEM EDUCATION
CATALOG OF HEALTH ACTIVITIES AND ITEMS...
IN THE KITCHEN...
IN THE BATHROOM...
IN THE DRAWER...
ACTIVITY: WE RUB THIS MEDICINE ON OUR HEADS OR OUR STOMACHS WHEN WE ARE SICK.
WHY? IT HELPS US WHEN WE HAVE A HEADACHE OR STOMACHACHE.
STEM
#31
How to launch STEM investigations

At school, Brenda routinely fails to engage in the practice of *systematic mixing* called for during science instruction.

For now, do the prediction in your mind and then
– I wonder why he didn't have them make a
685 prediction using the table?} He says that the students can get back to work.
686
687 Brenda and Steve's group has not numbered any of the squares so they are having a
688 difficult time telling which square is which in terms of what liquid is on which square.
689 They have not cut any spreaders either. They spread each liquid with the tip of the
690 dropper – the top of the bottle. They continue to try and figure out which square is
691 which. They have all of the squares on a brown, plastic tray – like a lunch room tray.
692 The squares are all jumbled up – no apparent order. Some are almost on top of one
693 another.
694
695 Brenda says, "It's good enough to drink. Just kidding!" Steve says, "Oh my gosh."
696 Brenda says, "What? It's probably been bottled up for years." She continues, "Did you
697 know that when water is old, it stinks?" Mr. A comes over and asks Steve what time it is.



STC Food Chemistry Kit


But she routinely engages in that practice at home.
Bricker & Bell, 2014

Overview of the Micros & Me Curriculum: The Microbiology of Human Health

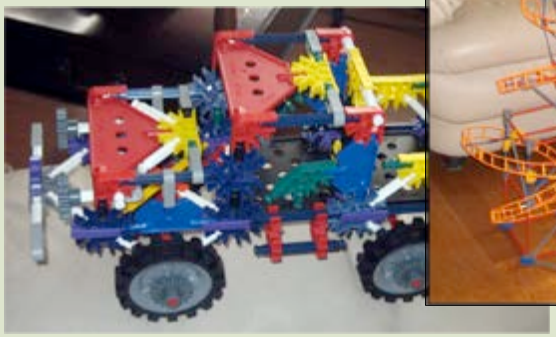
- Part 1: Framing around microbiolo
  health practices
  - Germ simulation
  - *Community self-documentation / interv*
- Part 2: Select lessons from origina
  - Microscope use/magnification
  - What are cells?
- Part 3: Student-led investigations into microbiology and health *(informed by student self-documentation)*
  - Micros in the school (sampling and studying microorganisms)
  - Beneficial micros (yeast fair test, yogurt making)
  - Handwashing technique fair test
  - Effectiveness of "green" cleaners fair test
- Part 4: Research project and development of Public Service Announcement (PSA)
  - *Based on practices documented in student self-documentation*
  - Based on scientific research

Brenda's participation shifts in the classroom when personal and cultural connections are leveraged. She discloses her science identity at school.

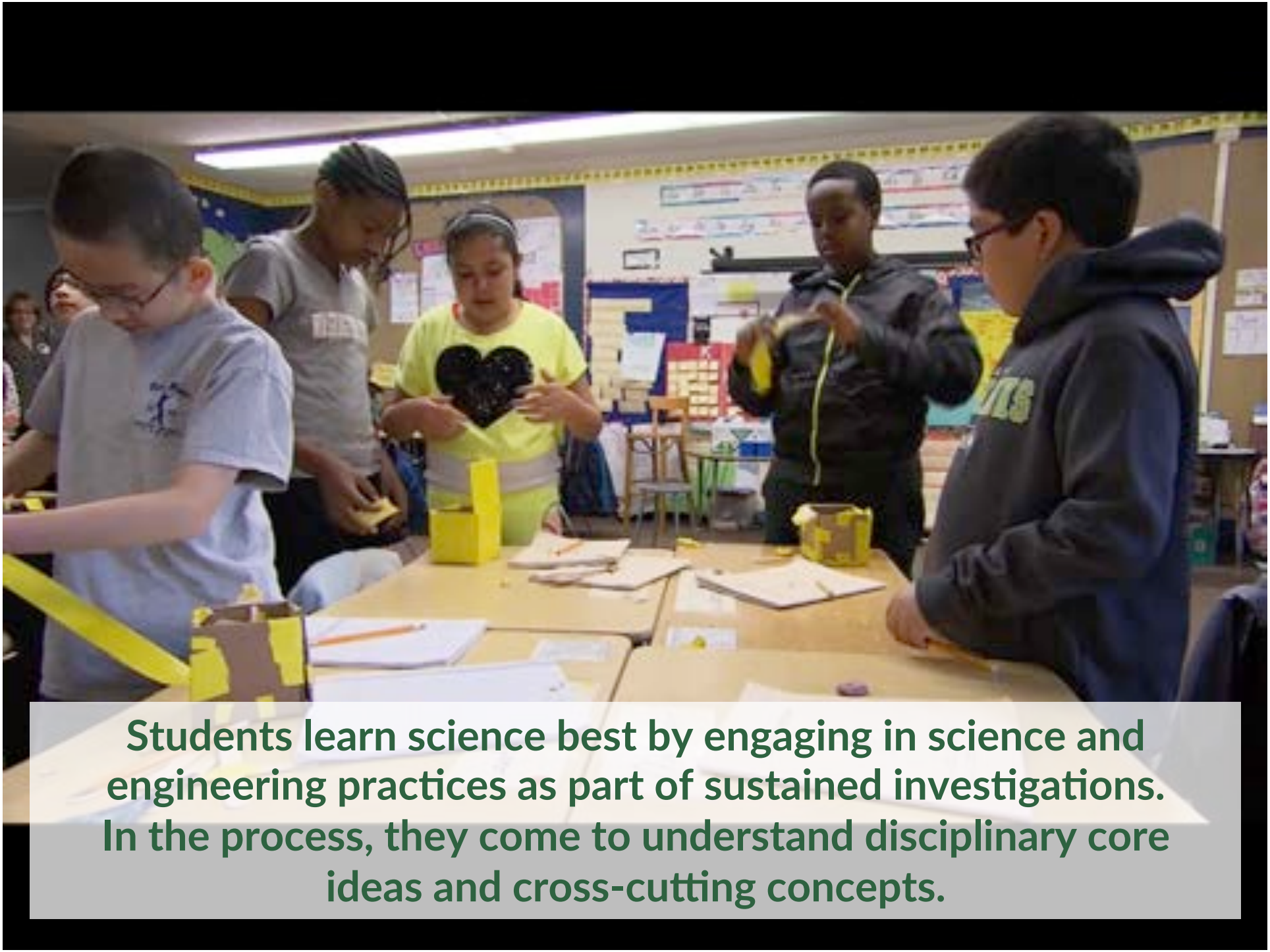
http://STEMteachingtools.org/brief/25

Sam & Engineering Design
(Bricker & Bell)

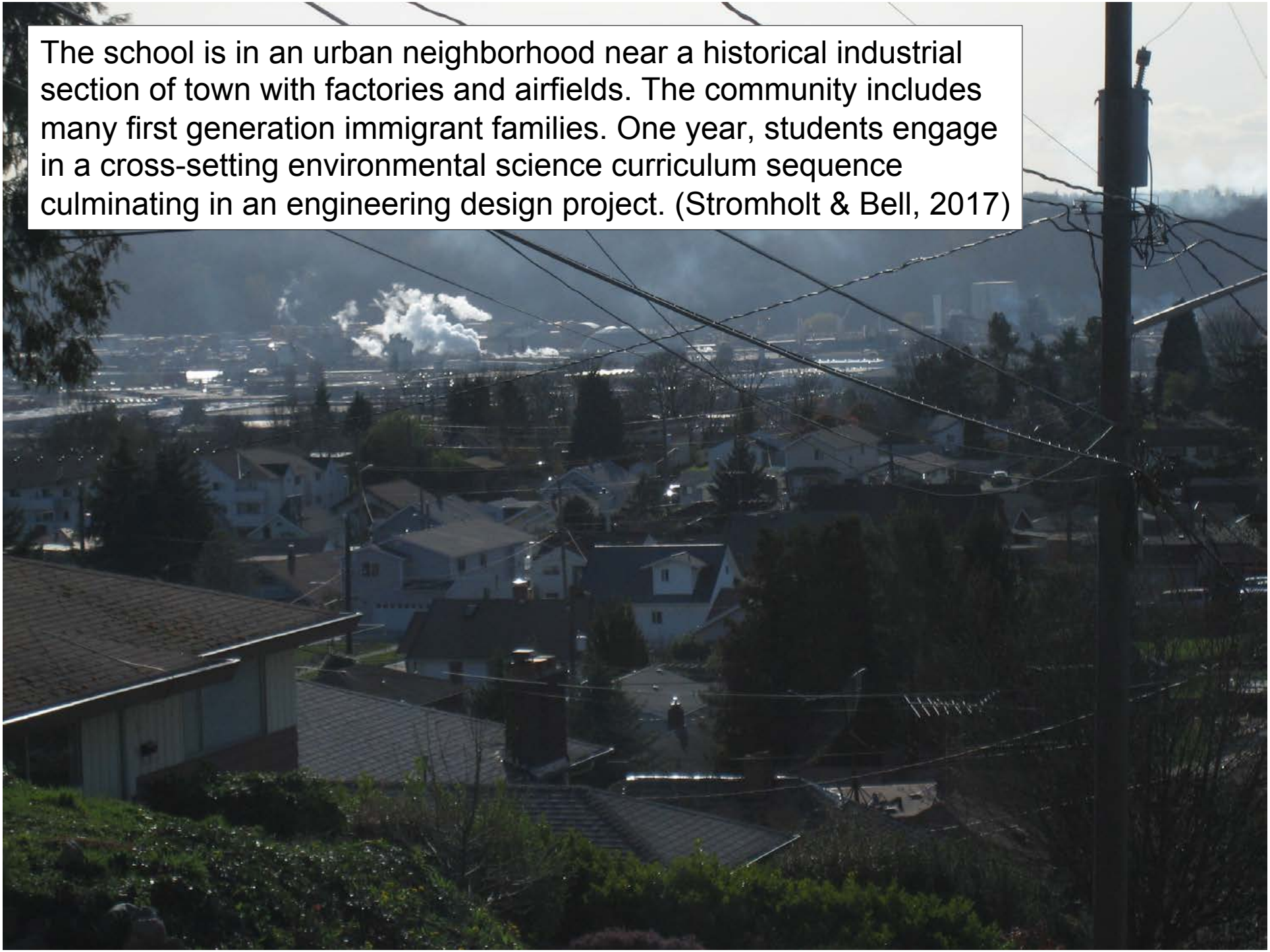
- Sam's leading definition for science is "building technology"
- He is a consummate designer, builder, and engineer



- Sam has a troubled academic identity at school



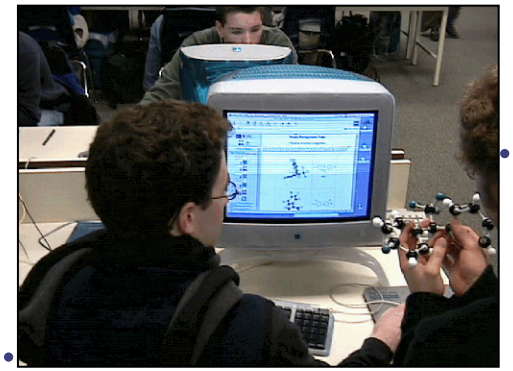
Students learn science best by engaging in science and engineering practices as part of sustained investigations. In the process, they come to understand disciplinary core ideas and cross-cutting concepts.


The school is in an urban neighborhood near a historical industrial section of town with factories and airfields. The community includes many first generation immigrant families. One year, students engage in a cross-setting environmental science curriculum sequence culminating in an engineering design project. (Stromholt & Bell, 2017)

Science Learning Happens Across Settings

Everyday Settings & Family Activities
(e.g., Bell et al., 2006; Callanan & Oakes, 1992; Crowley & Galco, 2001; Goodwin, 2007)

Designed Informal Settings
(e.g., Allen & Gutwill, 2004; Callanan & Jipson, 2001; Rennie & McLafferty, 2002)



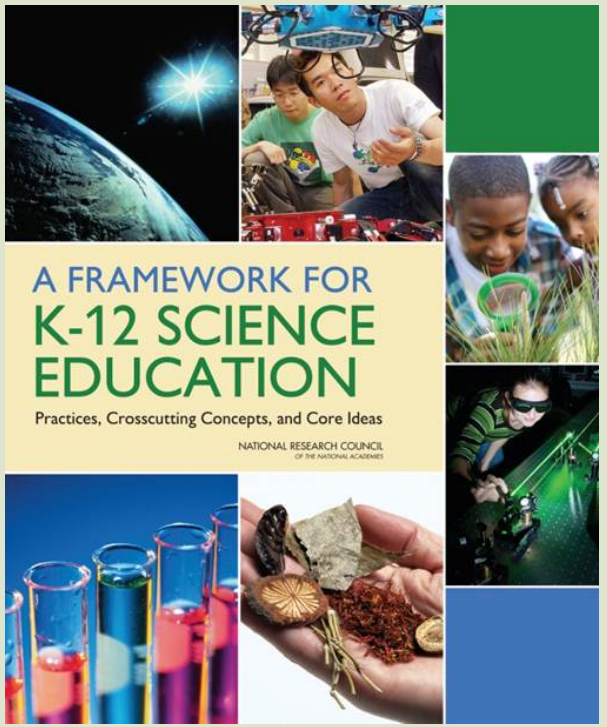
Classroom Instruction
(e.g., Barton, et al., 2003; Bell, 2004; Davis, 2003; Linn, 2006; Newton et al., 1999; Reiser et al., 2008)

Out-of-School Programs
(e.g., Halpern, 2002; Noam, et al., 2003; Gibson & Chase, 2002)

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."

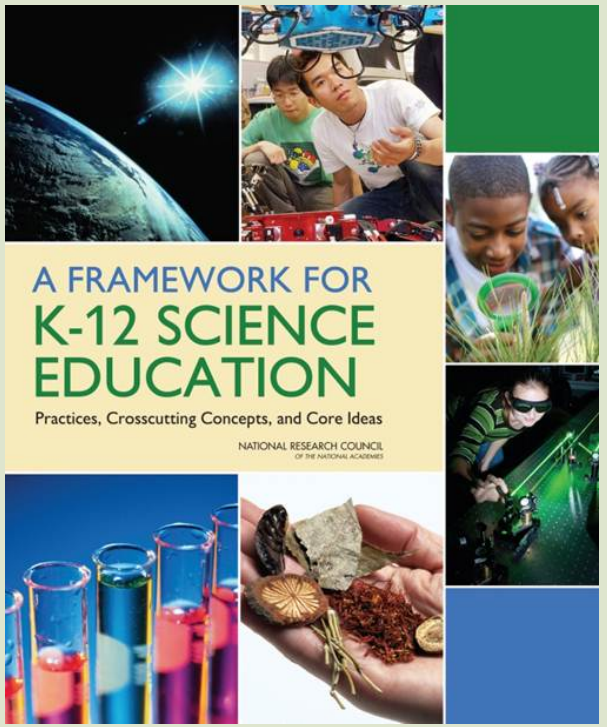
— *NRC Framework*, p. 287



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."

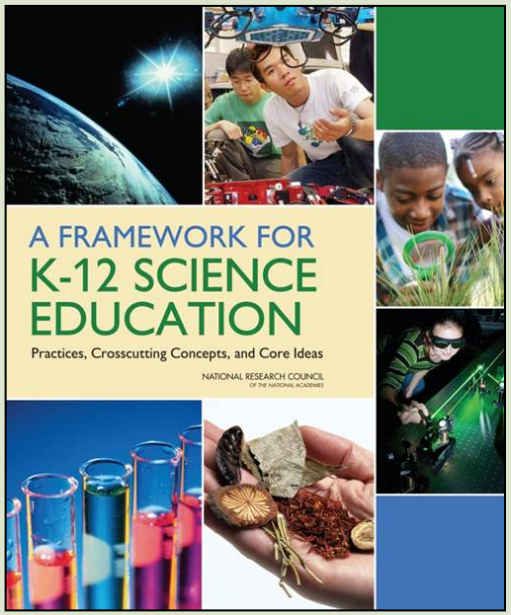
— *NRC Framework*, p. 287

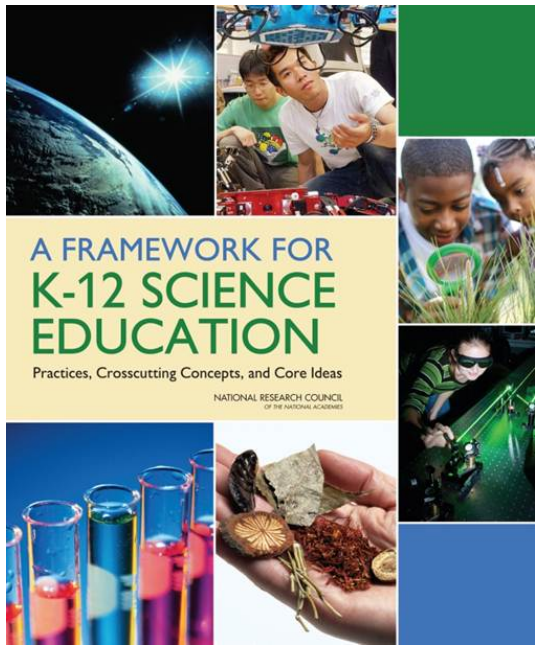


Make Deep Community Connections

"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."

— NRC, 2012, p. 278





Science & Engineering Practices

×

Crosscutting Concepts

×

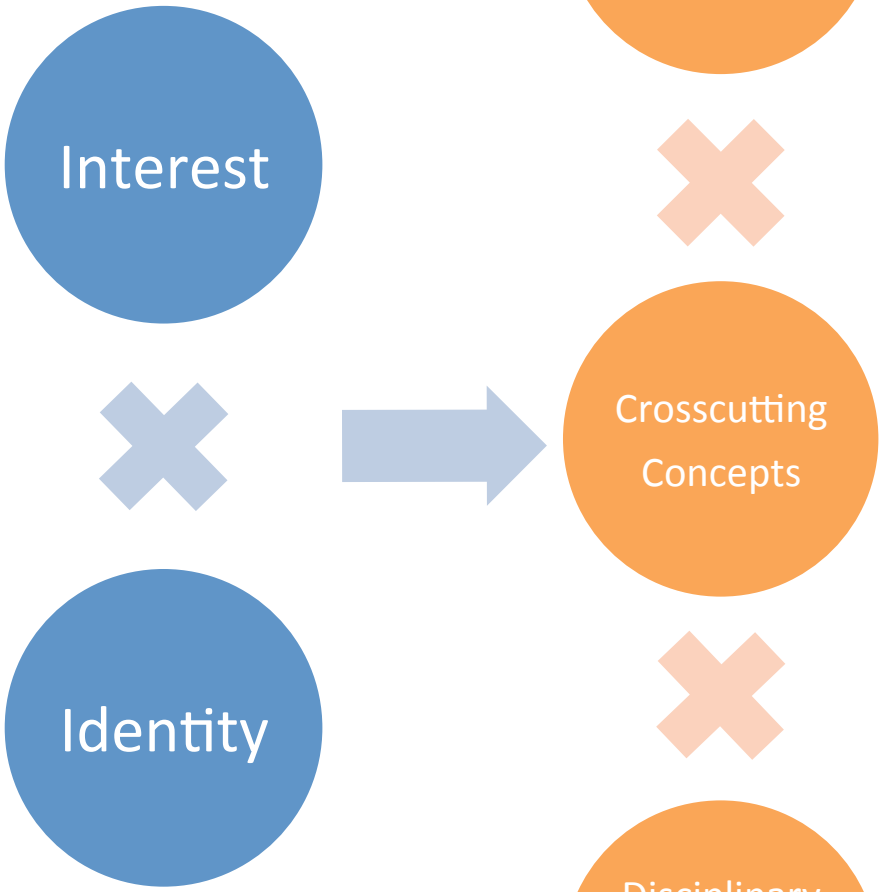
Disciplinary Core Ideas

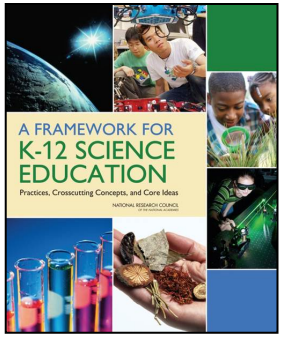
3D Learning is Powerful

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

We actually need 5D Learning!

For Meaningful Experiences





Building on Learners' Prior Interest & Identity is Key

Different Formative Assessment Intervention Models (Penuel & Shepard)

Data-Driven Decision-Making

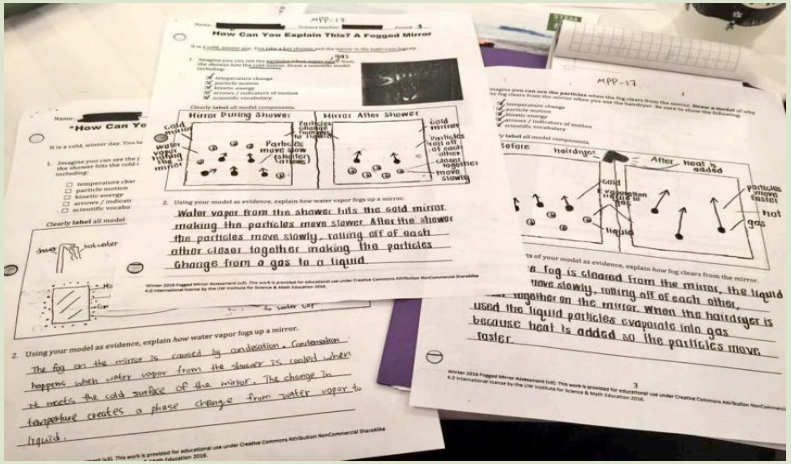
Student 1	
Student 2	
Student 3	
Student 4	

Strategy-Focused

	Where the learner is going	Where the learner is	How to get there
Teacher	Clarify and share learning intentions	Engineering effective discussions, tasks and activities that elicit evidence of learning	Providing feedback that moves learners forward
Peer	Understand and share learning intentions	Activating learners as learning resources for one another	
Learner	Understand learning intentions	Activating learners as owners of their own learning	

Figure 1: Key aspects of formative assessment (Black and Wiliam, 2009)

Cognitive

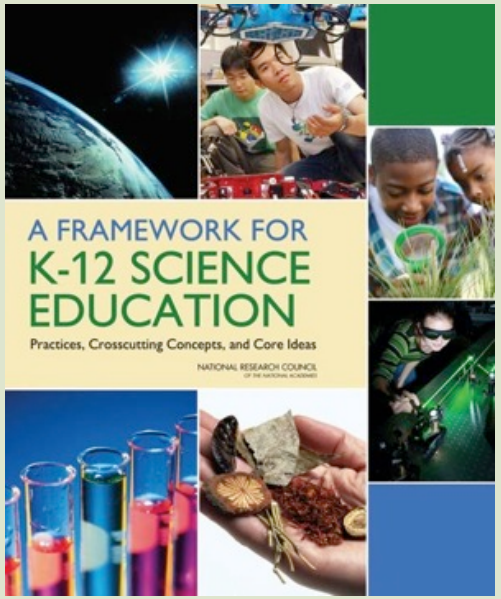


Cultural

Science Learning as a Cultural Process

Dimensions of Equitable Science Instruction from 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



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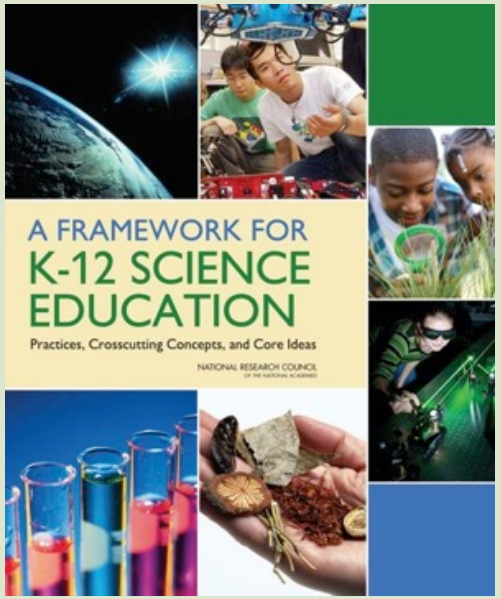
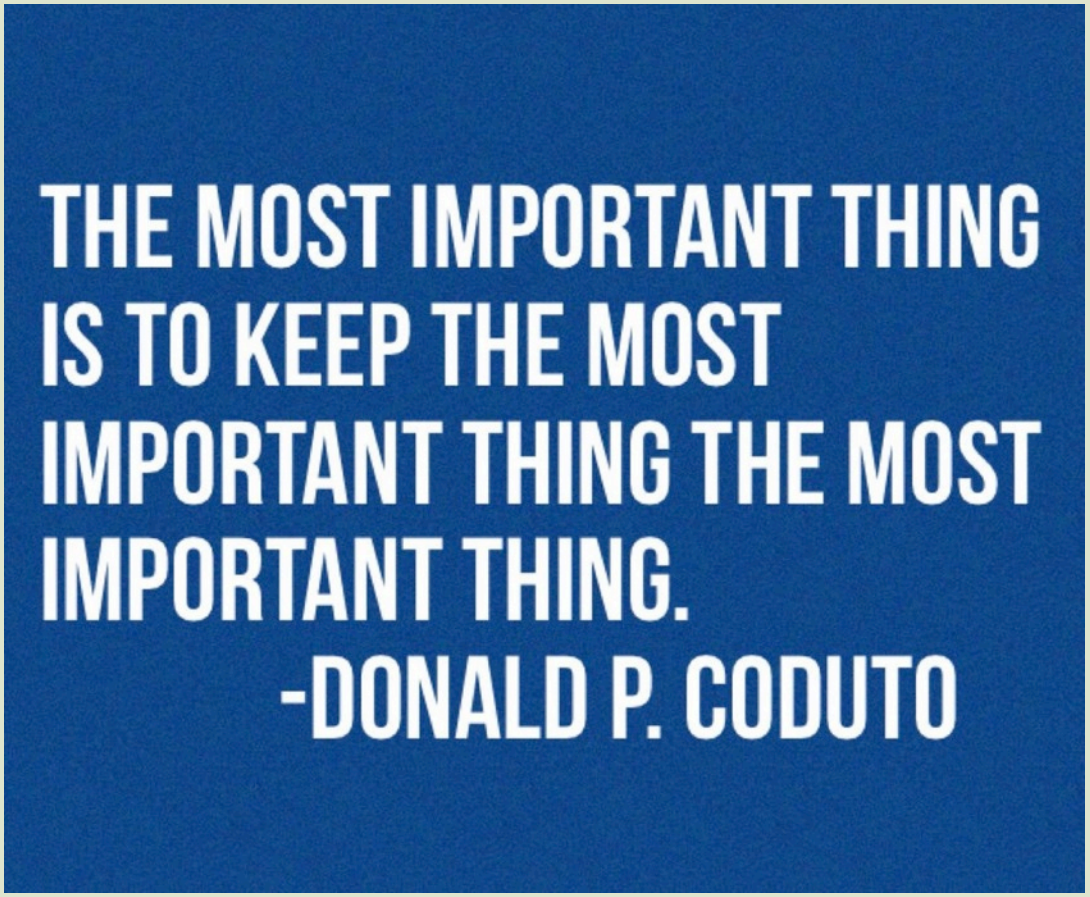


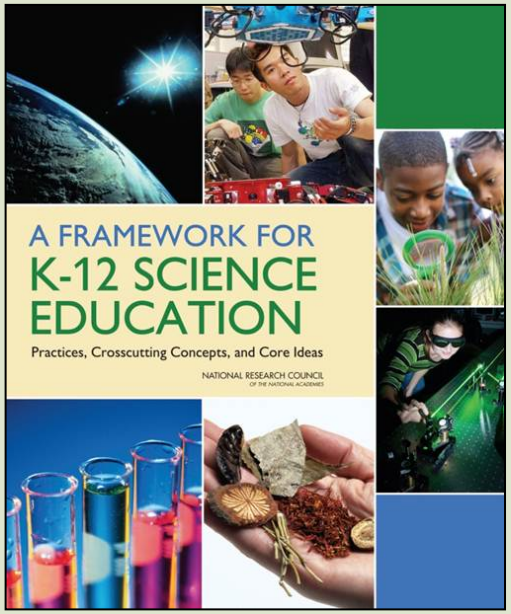

THE MOST IMPORTANT THING
IS TO KEEP THE MOST
IMPORTANT THING THE MOST
IMPORTANT THING.
-DONALD P. CODUTO

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).

"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



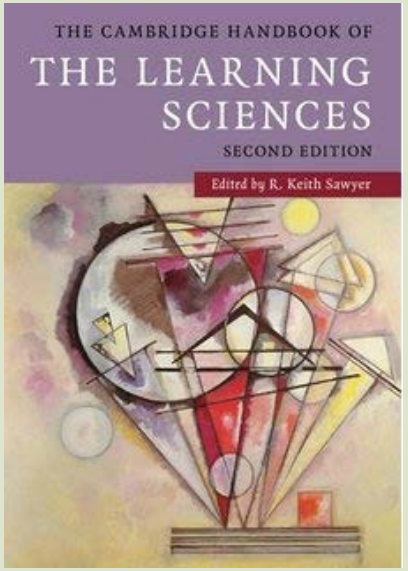
What does “culture” mean?

- **Culture is not a trait** that some people have and others do not. **We are all cultural beings.**
- Culture includes **the ways in which human beings engage and make sense of the world** as we participate in the everyday activities of our communities.
- Culture reflects socially and historically organized ways of living and making sense of life—or what might be called “**sensemaking repertoires**.”
- Often, cultural worlds of youth from non-dominant communities are viewed from a deficit perspective—rather than a source of **increased rigor and relevance**.

What does “culture” mean?

“By ‘culture,’ we mean the **constellations of practices** communities have historically developed and dynamically shaped in order to accomplish **the purposes they value**, including the **tools they use**, **social networks** with which they are connected, **ways they organize joint activity**, and their **ways of conceptualizing and engaging with the world**.”

— Nasir, et al., 2014, p. 686



Activity: Make a list of cultural groups you belong to—at work, in your personal life, online. Post a few of your cultural communities to the chat (e.g., go hiking).

What does “culture” mean?

Did you include something about *science* in your list of cultural communities? All science educators participate in the cultural endeavor of science, and we want students to participate in it as well.

“In this [cultural] view, learning and development can be seen as the acquisition throughout the life course of diverse repertoires of overlapping, complementary or even conflicting cultural practices.”

— Nasir, et al., 2014, p. 686

The cultural practices we need to attend to most are those used to make sense of the natural world. Learning in this view means *shifts* in participation.

What does "culture" mean in science education?

- Cultural specifics related to science may involve:
  - To what extent they find scientific topics salient or interesting
  - How students experience, observe, and narrate phenomena
  - How familiar they are with design and working through failure
  - How they communicate and how they engage with elders
  - How they pose questions or engage in argumentative and explanatory talk and writing
- Cultural diversity benefits science, and it benefits science learning. Research shows it is crucial to approach the different cultural ways of knowing that youth bring to science learning from as an asset perspective (NRC *Framework*, 2012).

Implementing Meaningful STEM Education with Indigenous Students & Families

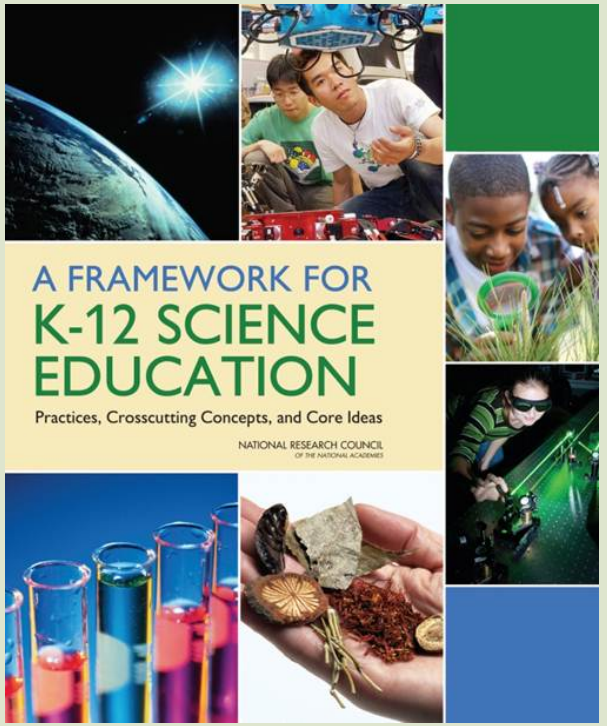
http://STEMteachingtools.org/brief/11

What does “culture” mean?

“Everyday experience provides a rich base of knowledge and experience to support **conceptual changes in science**.”

“Everyday contexts and situations that are important in children’s lives not only influence their **repertoires of practice** but also are likely to support their development of **complex cognitive skills**.”

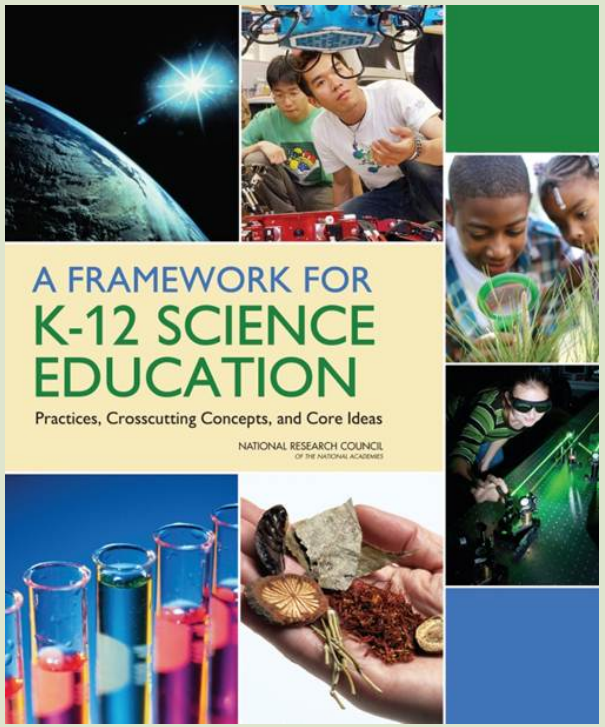
– NRC Framework, 2012, p. 284



Educational Implications of Culture

"A culturally responsive approach to science instruction involves the recognition of community practices and knowledge as being central to the scientific endeavor."

—NRC Framework, 2012, p. 285



Activity: Think of a science topic and a community you are deeply familiar with. How might the community's sense-making practices, knowledge, and interests help frame the topic?

http://STEMteachingtools.org/ (Coming Soon!)

Known Pitfalls When Taking Up Culturally Relevant Instruction

When engaging in this work…

- Do NOT assume that specific cultural groups engage in certain practices (i.e., don't essentialize)
- Do NOT send the message that the dominant culture has no culture (i.e., that it is "normal")
- Do NOT ask students to shoulder the burden of representing what "their culture" is like (i.e., no individual speaks for their culture, race, or gender)
- Do NOT make token references to the history of cultural groups; Instead DO interweave cultural history, present, and future more deeply into instruction
- AVOID the epistemic injury of students

Cultural Formative Assessment Focused on Learner Interests & Experiences

Cultural formative assessment can be used to support equity & social justice

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?**

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.

Building on Prior Interest & Identity

"Students are likely to bring diverse interests and experiences to the classroom from their families and cultural communities. A potential focus of classroom assessment at the outset of instruction is to elicit students' interests and experiences that may be relevant to the goals for instruction."

— *NRC*, p. 127

http://STEMteachingtools.org/brief/31

Overview of the Micros & Me Curriculum: The Microbiology of Human Health

- Part 1: Framing around microbiology and community-based health practices
  - Germ simulation
  - *Community self-documentation / interviews*
- Part 2: Select lessons from original *Microworlds* kit
  - Microscope use/magnification
  - What are cells?
- Part 3: Student-led investigations into microbiology and health *(informed by student self-documentation)*
  - Micros in the school (sampling and studying microorganisms)
  - Beneficial micros (yeast fair test, yogurt making)
  - Handwashing technique fair test
  - Effectiveness of "green" cleaners fair test
- Part 4: Research project and development of Public Service Announcement (PSA)
  - *Based on practices documented in student self-documentation*
  - Based on scientific research

Surfacing cultural health practices through self-documentation (Tzou & Bell, 2006)

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

Making Out-of-School Practices and Interests Visible in Classrooms Through Self-Documentation

What are the things you and your family do to stay healthy and keep from getting sick?

As you take your pictures, please fill out the following chart. We have given you three examples.

What is this picture?	*Where did you take this picture?*	*What activity does this picture explain?*	*How does this activity help you stay healthy and/or keep you from getting sick?*
1. This is a picture of a bottle of vitamins.	This was in my bathroom.	I take a vitamin every morning.	I take vitamins so that my body has everything it needs to do its job, even if I don't eat all of the types of foods I should.
2. This is a picture of a shot.	This is a picture of a magazine ad.	I get a flu shot every year.	I get a flu shot every year so that I hopefully don't get the flu.
3. This is a picture of me making tea.	My brother took this picture of me in the kitchen of our house.	My family drinks this tea that we get from a store in our neighborhood.	My grandmother says that this tea helps people not catch the flu.
4.			
5.			


Community Health Issues
*(That involve Micros)
*littering
*Smoking / 2nd hand smoke
- obesity
*burning coal
*car pollution
*hygiene
*Kids not exercising
- alcoholism
*taking vitamins
- eating junkfood
*washing hands
*handling food
*construction sites
*drinking water
*access to healthy food
- over consumption
*ear I got ear infections
- landfills (where they are?)
- recycling
*addicted to pain medicine (xanax)
* illegal drug use
*Sharing things you are not supposed to share
*cutting down trees
*coming to school when sick
-
Pictures of Community Health in F2
Pictures of Community Health in F3
FIRE EXTINGUISHER

Activity: As I show the next few slides, analyze the student "self-docs." Look for interests and everyday practices that could be connected to a 'microbiology of health' unit.

Try to identify:

1. One or two interest-driven lesson connections or investigations students could engage in

2. Whether or not you would want students to scientifically test specific family practices

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

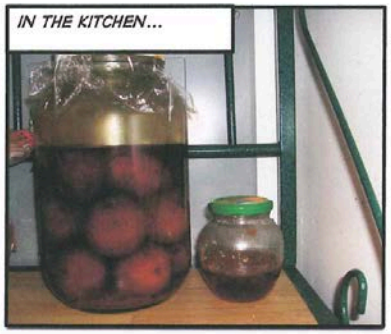
WE EAT VEGETABLES EVERY DAY

EATING VEGETABLES IS HEALTHY THAT'S WHAT MOM SAYS

CATALOG OF HEALTH ACTIVITIES AND ITEMS...

#2

IN THE KITCHEN...



ACTIVITY: I DRINK SALTED LEMONS WITH HONEY WHENEVER I HAVE A COUGH.

WHY? MY MOM SAID IT WILL HELP ME CURE MY COUGH.

IN THE BATHROOM...

ACTIVITY: WE WASH OUR HANDS EVERY DAY.

WHY? WE WON'T PUT GERMS IN OUR FOOD AND IT HELPS US WASH THE BAD STUFF IN OUR HANDS.

IN THE DRAWER...

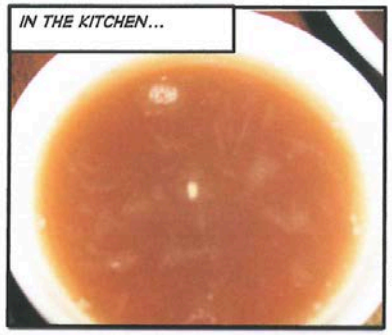
ACTIVITY: WE RUB THIS MEDICINE ON OUR HEADS OR OUR STOMACHS WHEN WE ARE SICK.

WHY? IT HELPS US WHEN WE HAVE A HEADACHE OR STOMACHACHE.

[redacted]'S CATALOG OF HEALTH ACTIVITIES AND ITEMS...

#1

IN THE KITCHEN...



ACTIVITY: MY FAMILY DRINKS THIS SO THEY WOULD GET STRONGER

WHY? MY MOM SAID THE SOUP WILL GIVE ME ENERGY AND HELP ME GET STRONGER

IN THE BEDROOM...

ACTIVITY: THIS SPRAY HEALS MY CANKER SORES.

WHY? MY MOM SAID IT WOULD HEAL MY CANKER SORE.

IN THE LIVING ROOM...

ACTIVITY: I TAKE THIS CHINESE THROAT CANDY FOR MY SORE THROAT.

WHY? MY MOM'S DOCTOR SAID IT WILL HELP MY SORE THROAT.

[redacted]'S CATALOG OF HEALTH ACTIVITIES AND ITEMS...

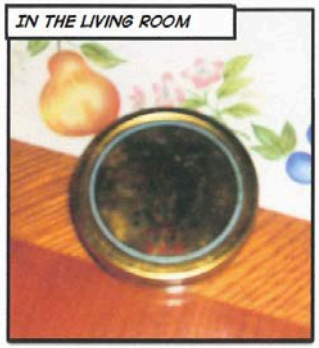
#10

IN THE LIVING ROOM

TO CLEAN MY HANDS

WHEN I TOUCHED SOMETHING DIRTY I USE IT

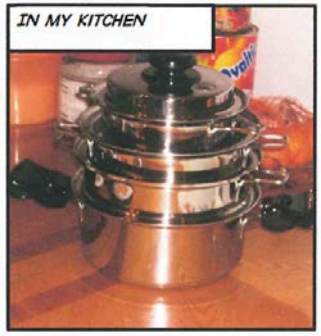
IN THE LIVING ROOM



THIS IS A PICTURE OF SANITARY BALM TO EASE THE PAIN

WHEN MY STOMACH HURTS

IN MY KITCHEN



THIS IS A PICTURE OF SALAD MASTERS POTS.

IT HAS METAL COMPOSITION. TITANIUM STAINLESS STEEL. IT RETAINS NUTRIENTS AND FLAVORS OF FOOD

[redacted]'S CATALOG OF HEALTH ACTIVITIES AND ITEMS...

#5

ON THE KITCHEN COUNTER...

ACTIVITY: MY FAMILY CUTS UP GINGER AND THEN [PUTS IT] IN THE TEA.

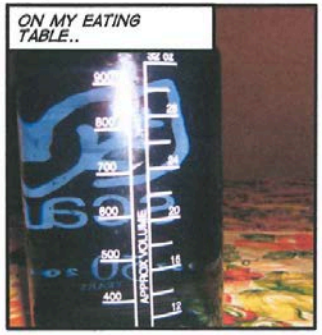
WHY? THIS IS DONE AT MY HOUSE WHEN SOMEONE HAS A COLD.

IN THE KITCHEN...

ACTIVITY: MY FAMILY DRINKS TEA EVERY MORNING.

WHY? MY DAD TOLD ME THAT TEA GIVES YOU MORE BLOOD.

ON MY EATING TABLE..



ACTIVITY: I DRINK WATER EVERY DAY.

WHY?MY COACH SAID TO DRINK WATER WHEN YOU HAVE A COLD TO CLEAN YOUR BODY..

[redacted]'S CATALOG OF HEALTH ACTIVITIES AND ITEMS...

#6

IN THE KITCHEN

PEOPLE IN MY CULTURE SAY TO EAT CHICKEN SOUP WHEN YOU'RE SICK

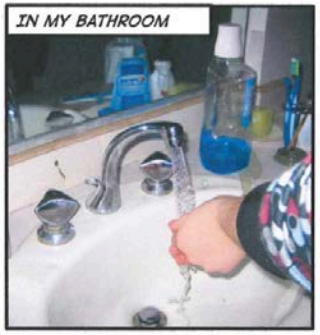
MY FAMILY AND FRIENDS TELL ME THAT IT WILL MAKE YOU FEEL BETTER

IN MY BATHROOM

BRUSHING YOUR TEETH

HELPS KEEP YOU HEALTHY BY REMOVING PLAQUE. I BRUSH MY TEETH TWICE A DAY

IN MY BATHROOM



WASHING YOUR HANDS WITH SOAP AND WATER

HELPS KILL GERMS. I WASH MY HANDS AFTER USING THE BATHROOM, BEFORE EATING, AND AT OTHER TIMES

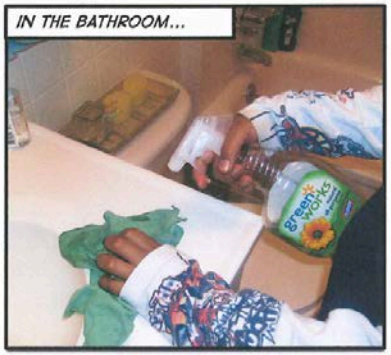
[redacted] CATALOG OF HEALTH ACTIVITIES AND ITEMS...

IN THE KITCHEN...

ACTIVITY: I DRINK THESE WHEN I AM THIRSTY.

WHY? THEY KEEP ME HYDRATED.

IN THE BATHROOM...



ACTIVITY: I CLEAN THE BATHROOM EVERY WEEK.

WHY? I DO THIS TO REMOVE BACTERIA.

IN THE KITCHEN...

ACTIVITY: I CLIP MY FINGERNAILS EVERY TWO DAYS.

WHY? IT HELPS ME CLEAN MY HANDS FASTER.

[redacted] CATALOG OF HEALTH ACTIVITIES AND ITEMS...

IN MY KITCHEN...

ACTIVITY: IT WILL MAKE YOU WANT MORE BECAUSE THERE IS A LOT OF SALT IN THEM (PACKET OF RAW NOODLES).

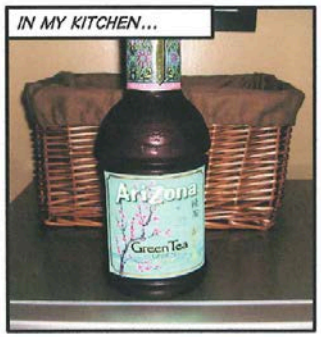
WHY? IT CAN MAKE YOU SICK BECAUSE THERE IS A LOT OF SALT AND MSG.

IN MY KITCHEN...

ACTIVITY: IT (VENTI MOCHA FRAPPACHINO) GIVES YOU ENERGY AND SUGAR.

WHY? IT GIVES YOU CAFFEINE AND CAFFEINE IS A BAD THING IF YOU HAVE A LOT OF IT.

IN MY KITCHEN...



ACTIVITY: GREEN TEA IS CALMING TO THE BODY AND HELPS YOU.

WHY? IT KEEPS YOU HEALTHY IF YOU DON'T HAVE TOO MUCH OF IT..

Designing Cultural Formative Assessments: Overlapping Curriculum with the Lives of Students

Designing a Self-Doc Assessment

1. Think about a self-doc task you could use for a specific purpose. Here are some sample prompts:
   - **Culturally Relevant Instruction:** What are the things you and your family do to stay healthy?
   - **Cultural Sources or "Funds" of Knowledge:** Which groups or individuals in our community engage in systematic design? What do they design?
   - **Relating Science to a Community Project:** What environmental challenges are faced by your community?
2. Select the purpose for the self-doc and draft a prompt for your self-doc task.
3. Share your draft with colleagues, review their feedback, and revise it.

Other self-documentation ideas:

1. Ask students share their interests, passions, hobbies & areas of expertise with you

2. Ask students to map scientific ideas to ‘everyday instances’ in their cultural worlds (e.g., Where do you see erosion and deposition in your community? Where do you see Newton’s second law in your life?)

3. As students to document what they find to be interesting in their science investigations, fieldtrips, or guest presentation?

Suggested Formats for Cultural Formative Assessment

- **Self-documentation:** pictures, videos, descriptions of everyday life
- **Periodic surveys:** to surface instruction-related interests and life experiences to leverage
- **Exit tickets about engagement and learning:** self-assessment surveys embedded within a lesson about student engagement, sense-making, affect, interests & experiences
- **Conversations:** provide time and facilitation for students to make connections to daily life

What might you ask students to do to help you bridge their everyday lives and classroom experiences?

Think about a specific piece of instruction that you want to make more culturally relevant—then consider which of the following goals you have for that instruction...

Goal: Establishing a New Interest

Are you trying to help students develop a new interest in a science-related topic, phenomena, idea, or practice?

If so, highlight the relevant aspect of science and discuss related details with students. Use an exit ticket to identify which students want to learn more about it—and provide them with follow-on learning resources.

Goal: Culturally Relevant Instruction

Are you trying to connect instruction to student's interests, hobbies, experiences, or expertise? Or to the practices and goals of their community?

If so, use self-documentation or an interest survey to draw out learning assets that can be related to instruction. You may identify phenomena students can investigate—or you may want to identify students who have relevant expertise to serve as "co-teachers."

Goal: Connecting to Cultural Sources, or "Funds" of Knowledge

Are you trying to connect instruction to the interests, concerns, experiences, or expertise of the community?

If so, use self-documentation or student interviewing of community members to surface these learning assets. You may identify phenomena students can investigate with community members.

Goal: Relating Science to a Community Project

Are you trying to help students see how scientific knowledge can inform a community endeavor?

If so, use self-documentation to identify actual community connections and focus an “action project” on researching and communicating with the community about the topic.

Goal: Learning about Possible Futures

Are you trying to help students learn how instruction connects to a possible future they might find desirable?

If so, help them see how the science knowledge and practices relate to social endeavors in the world, get them to express their interests, and resource them as possible. Support students using ***productive identity archetypes*** that help them build towards desired possible futures.

With NGSS / Framework there are different instructional uses for natural phenomena:

- **Anchoring Phenomena** frame curriculum units
- **Investigative Phenomena** focus student investigations & sense-making
- **Everyday Phenomena** make personally and culturally relevant connections

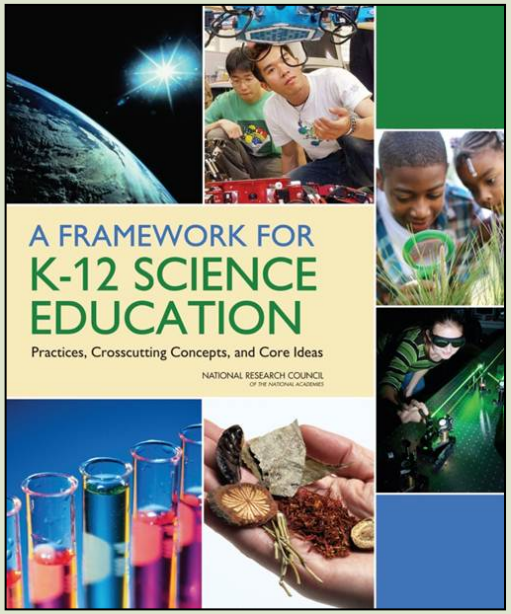
http://STEMteachingtools.org/brief/42
http://STEMteachingtools.org/brief/28

Reflection & Wrap Up

Reflecting back…

"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



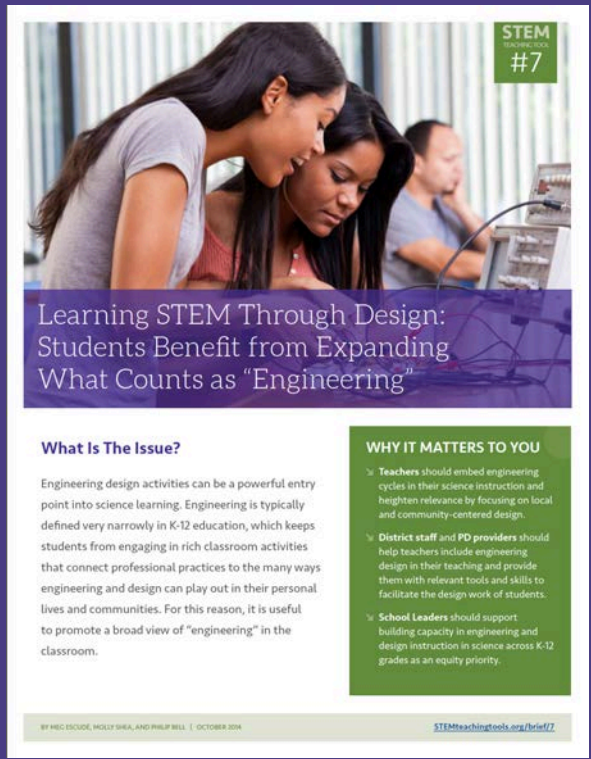
Broad Science Education Equity Goals to Work Towards

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

Professional Learning Resources to Support NGSS Implementation

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



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Please help us get the word out by retweeting!

We hope to share our resources for equitable 3D science instruction as far and wide possible. Please retweet this message to automatically enter yourself into a random drawing for a full-color print out set of our tools. We're giving away 25 full sets!

Practical tools for science educators | STEMTeachingTools.org | #NSFfunded

https://tinyurl.com/STT-Retweet-2018

Help us improve the resource

Please take this brief survey to help the ACESSE team improve this resource for others…

http://tinyurl.com/AcesseResourceC

Thank you! For more info…

Relevant Resources

- **STEM Teaching Tools**
  STEMteachingtools.org (web site)
  @STEMTeachTools (twitter)
  STEMTeachingTools (Facebook)
  STEMteachingtools.org/newsletter (newsletter sign-up)

- **Other ACESSE PD Modules on Formative Assessment**
  STEMteachingtools.org/PD

Contact Me

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ADVANCING COHERENT AND EQUITABLE SYSTEMS OF SCIENCE EDUCATION

Back Pocket Slides

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.

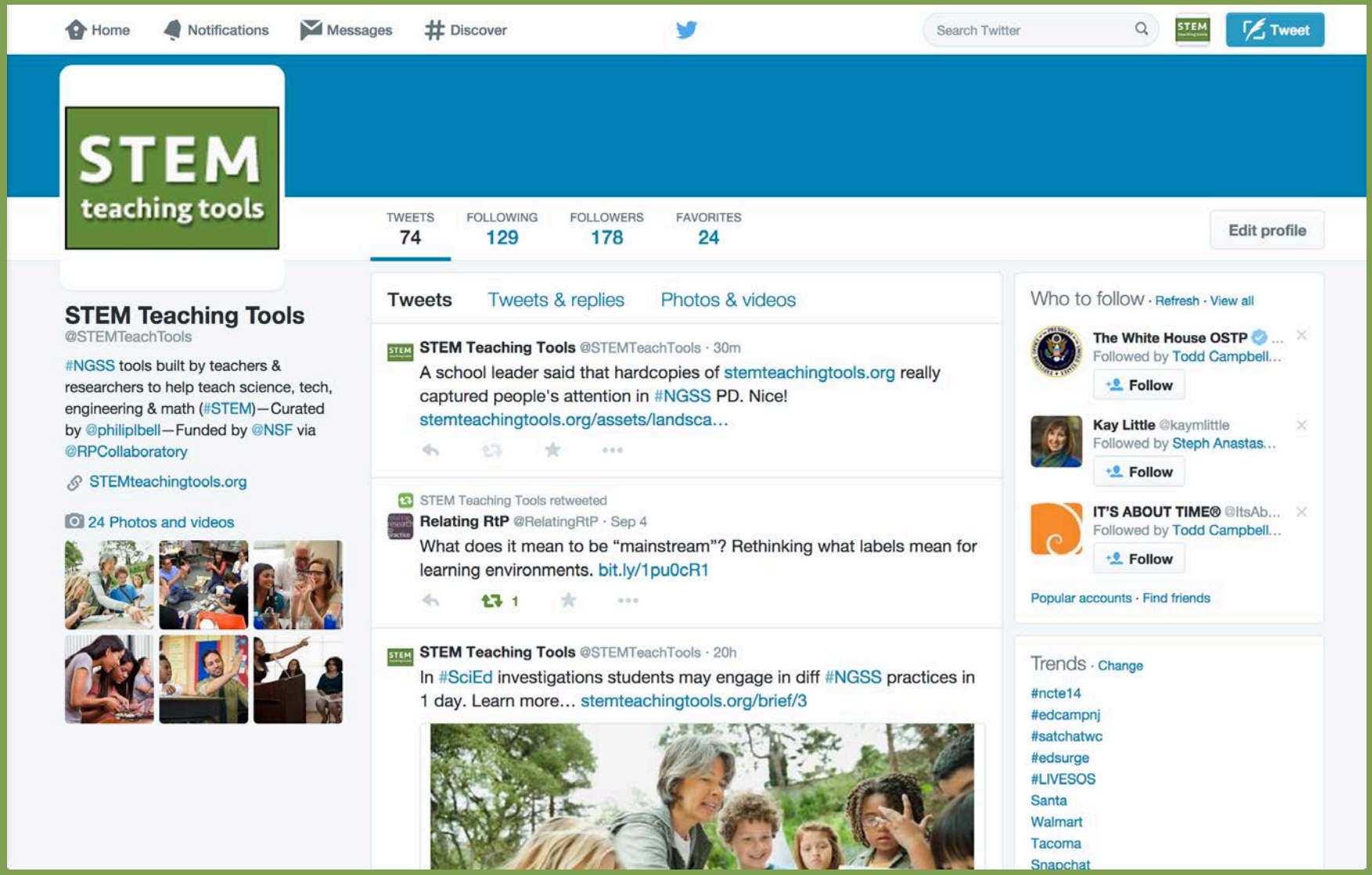
From: Bang, Brown, Calabrese Barton, Rosebery & Warren, Toward more equitable learning in science, In *Helping students make sense of the world using next generation science and engineering practices*, NSTA.

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… that might make sense in *your* context.

On Twitter
@STEMTeachTools



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http://stemteachingtools.org/newsletter

Newsletter Section: Field Notes

Field Notes is the email newsletter of STEM Teaching Tools, a regular compilation of new briefs, professional development resources, and other science education tools. Enter your email below to receive these periodic updates. This is a low-volume email list, and we promise not to share your address with others.

Your Email Send

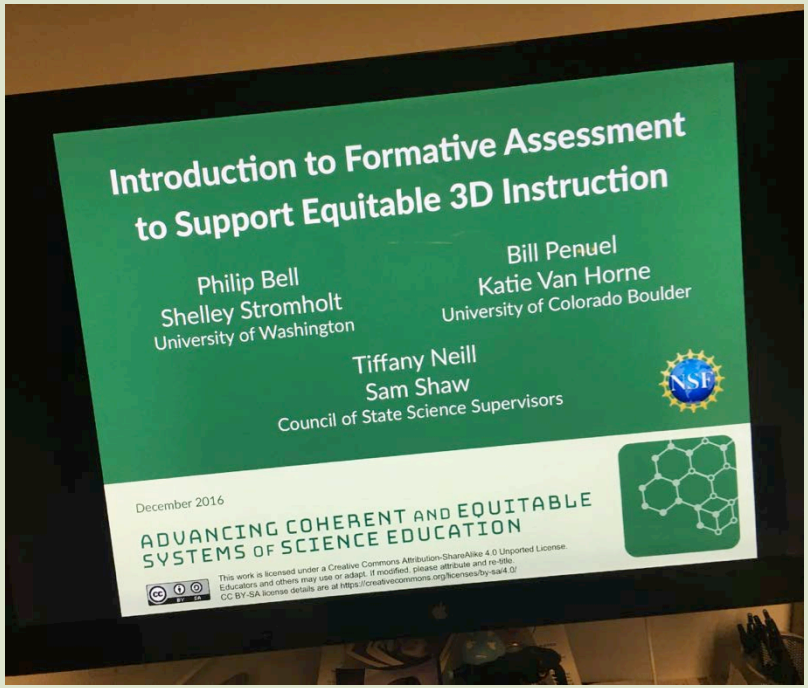
STEM Teaching Tools August 2017 Newsletter

STEM Teaching Tools June 2017 Newsletter

Currently Translating Select STTs…

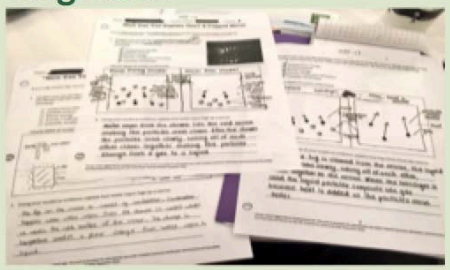
NAP.edu

ACESSE Resource A

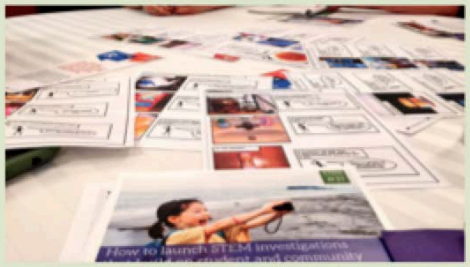


Overview: Participants develop a basic understanding of how formative assessment works and different approaches that have been used in science ed, including 3D cognitive and cultural approaches.

Cognitive



Cultural



Data-Driven Decision-Making

Student 1									
Student 2									
Student 3									
Student 4									

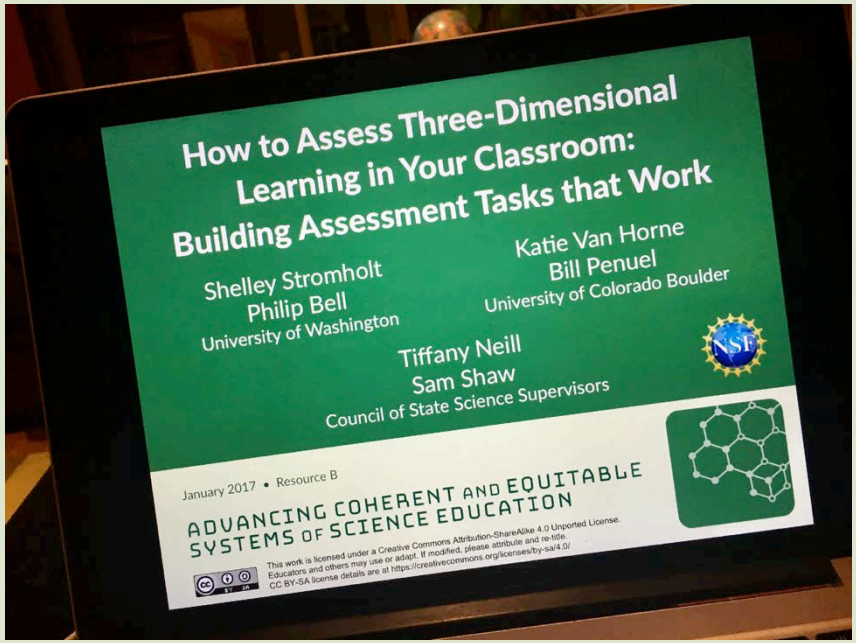
Strategy-Focused

	Where the learner is going	Where the learner is	How to get there
Teacher	Clarify and share learning intentions	Engineering effective discussions, tasks and activities that elicit evidence of learning	Providing feedback that moves learners forward
Peer	Understand and share learning intentions	Activating learners as learning resources for one another	
Learner	Understand learning intentions	Activating learners as owners of their own learning	

Figure 1: Key aspects of formative assessment (Black and Wiliam, 2009)

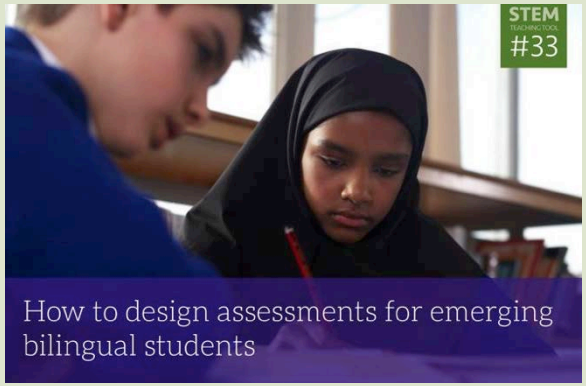
stemteachingtools.org/pd/SessionA

ACESSE Resource B



Overview: Participants will develop a shared, basic understanding of equitable 3D formative assessment and explore tools for revising or developing 3D assessment tasks that are fair for ELL students.

Format	Task Requirements for Students
1	Present two models to students, *then* Ask them to compare the models to identify both common and unique model components, relationships, and mechanisms.
2	Present students with an illustration or drawing of a scientific process or system, *then* Ask students to label the components, interactions, and mechanisms in the model, *and* Write a description of what is shown in the drawing.



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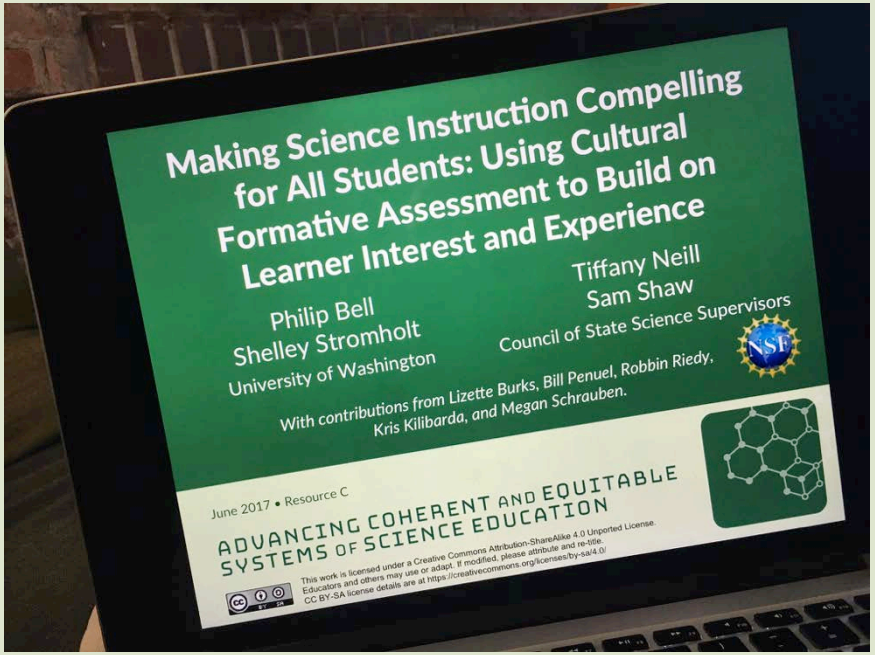
ACESSE Resource C



Overview: Participants learn how to design formative assessments that build on learners' interest and experience, promoting equity and social justice in the process.

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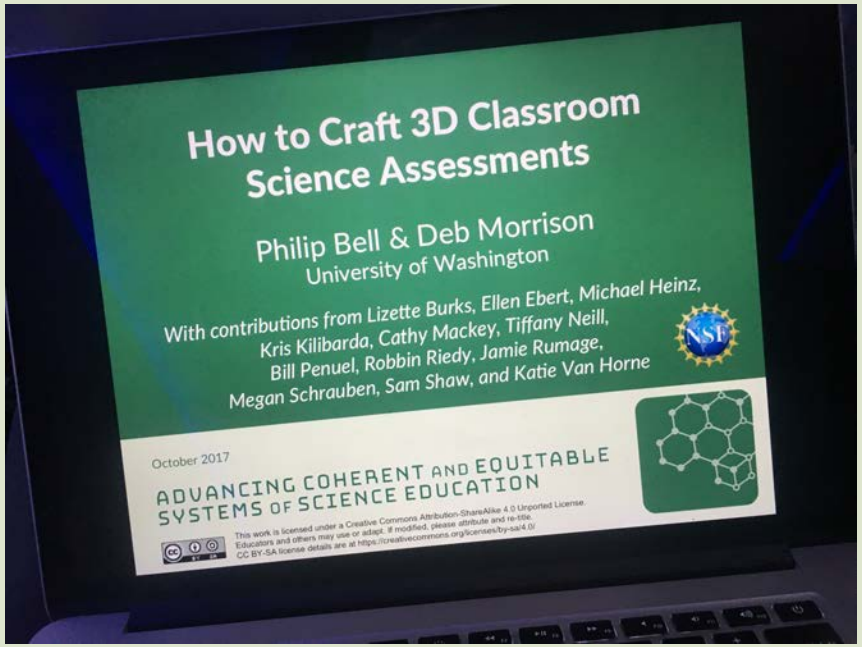
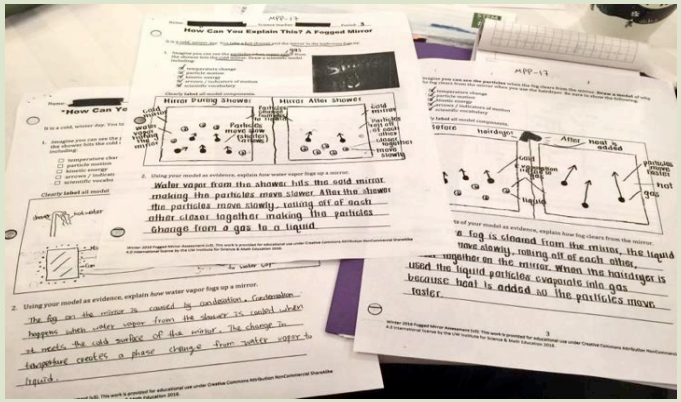
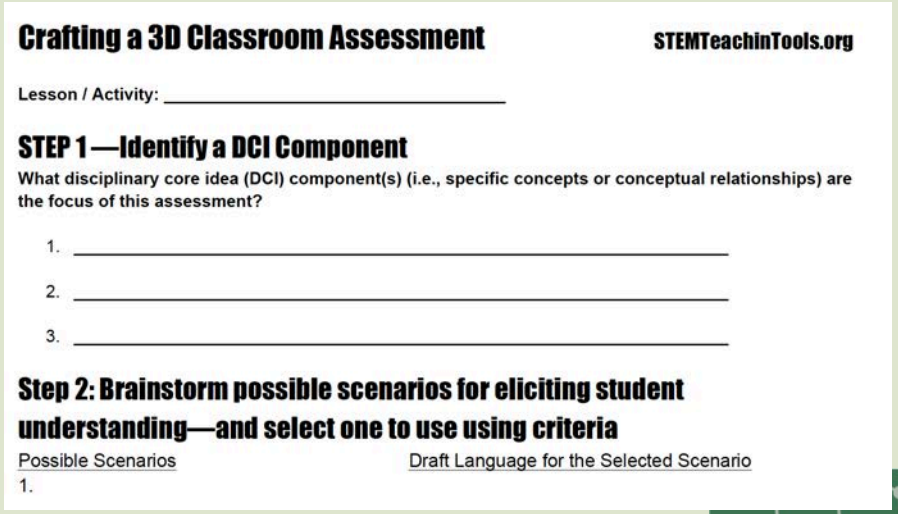
ACESSE Resource D



Overview: Participants will engage in crafting 3D learning performances and develop cognitive formative assessments for them. In the process, they learn deeply about three dimensional learning.





Crafting a 3D Classroom Assessment STEMTeachinTools.org

Lesson / Activity: _____

STEP 1—Identify a DCI Component

What disciplinary core idea (DCI) component(s) (i.e., specific concepts or conceptual relationships) are the focus of this assessment?

1. _____
2. _____
3. _____

Step 2: Brainstorm possible scenarios for eliciting student understanding—and select one to use using criteria

Possible Scenarios | Draft Language for the Selected Scenario

1.

stemteachingtools.org/pd/SessionD

(Brand New!)