

Improving Inservice Teacher Education with Design-Based Implementation Research

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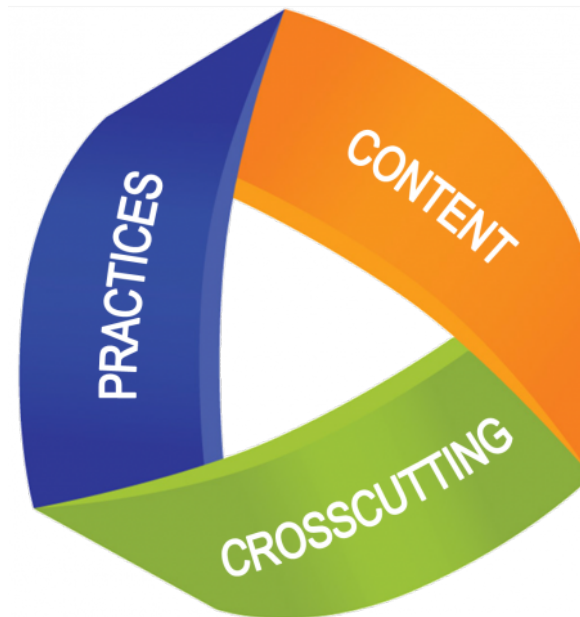
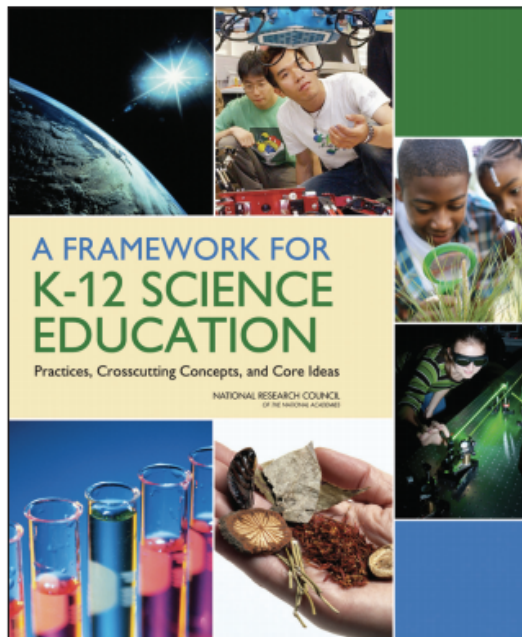
Teaching and Its Predicaments

Contemporary reforms with “ambitious” aims present dilemmas to teachers that are at once new and familiar:

- They demand new forms of expertise of teachers, but that expertise is not sufficient to guide teaching of diverse students, whose interest and commitment are necessary to meet those aims.
- The more they seek higher standards for students, the more they are likely to lead to student resistance, failure, or both. (Cohen, 2011).

In science education...

- Districts and states are moving forward with reforms linked to the vision of the *Framework for K-12 Science Education*



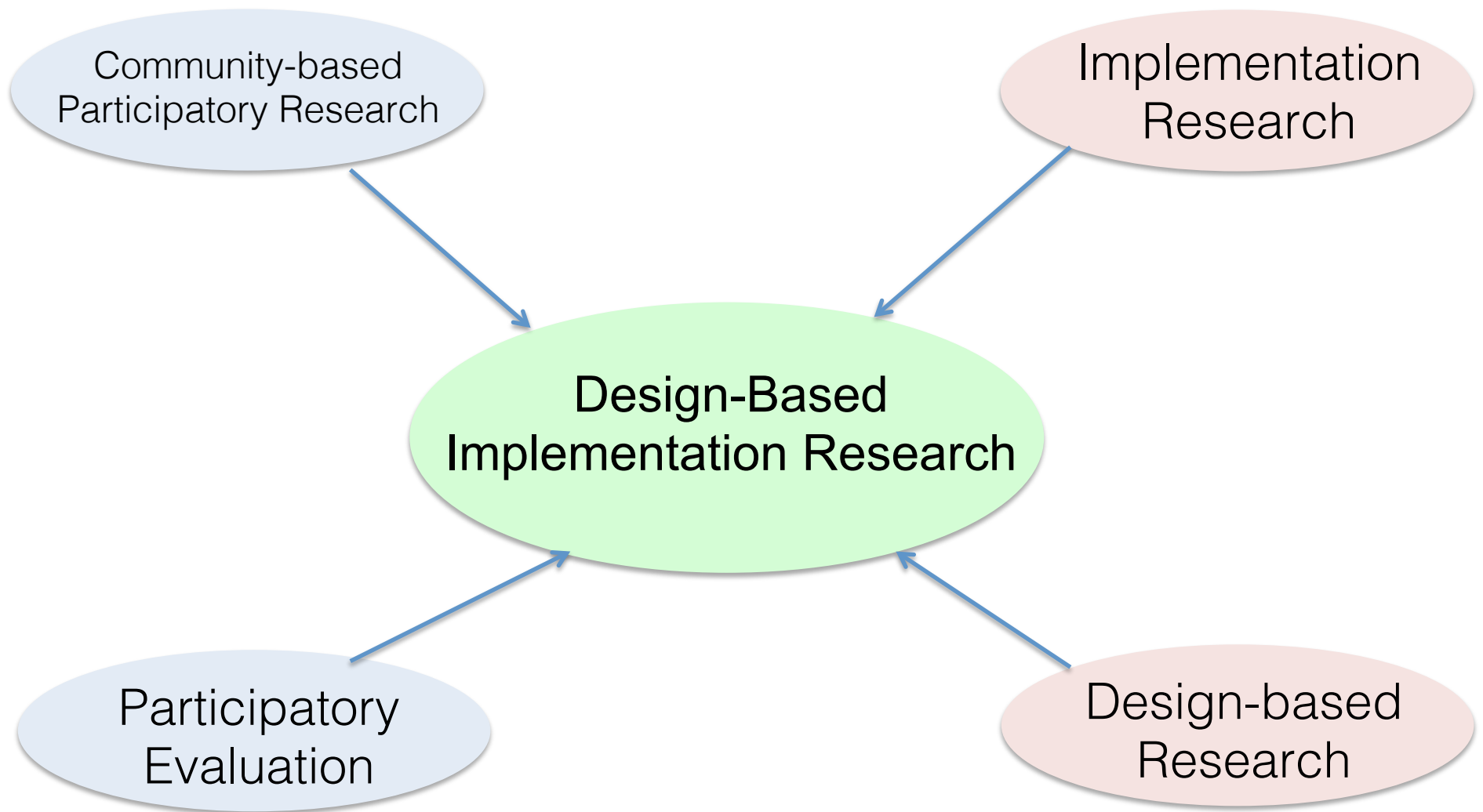
In science education...

Meanwhile, in school districts:

- Some teachers are being asked to address two sets of standards
- Pacing guides, interim assessments, and state assessment systems do not yet align with the vision of the *Framework*
- Teachers are left to do sensemaking to reconcile conflicting guidance on their own and with limited support (Allen & Penuel, in press, *JTE*).

And in the research community...

- Much of our research remains focused on:
 - Studying student learning within a single program or setting
 - Professional development as a means to develop teachers' content knowledge and pedagogical content knowledge
- When we do talk about scale, we usually mean scale-up *research* that tests the efficacy or effectiveness of particular professional development programs.



A Family of Approaches

...for relating research to practice
...for developing evidence related to innovations
...for bringing innovations to scale



“problem-solving research, development,
and implementation”



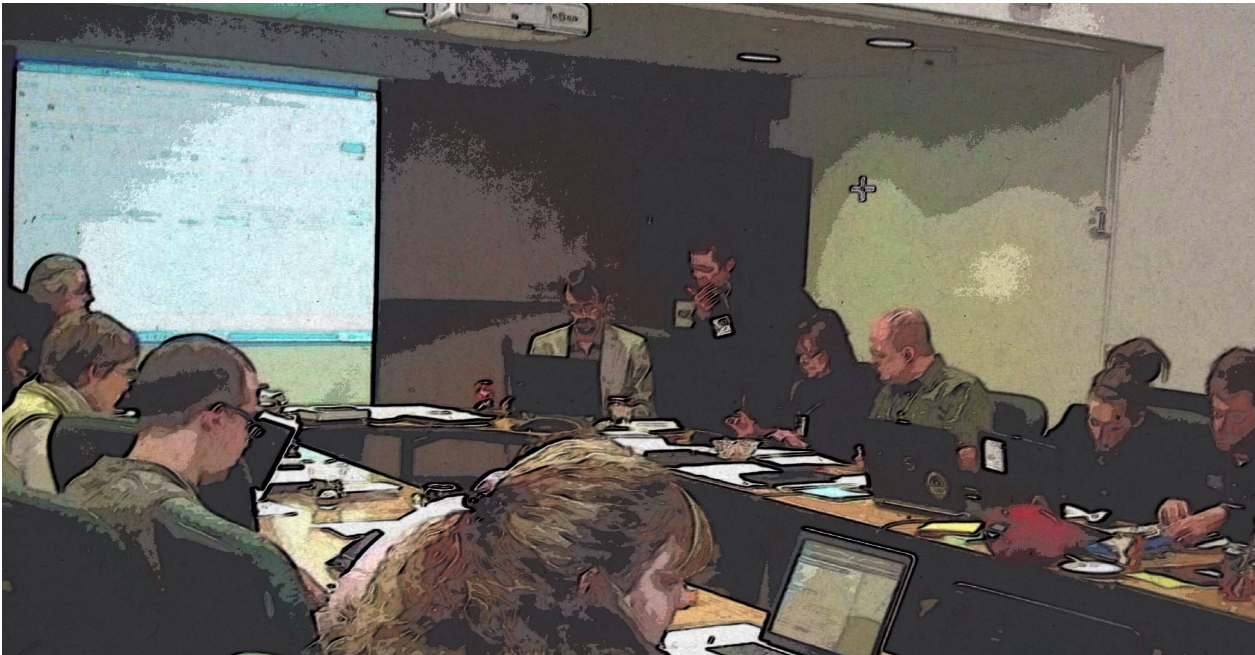
“designing for
improvement at scale”

Four Principles of DBIR

1. Teams form around a focus on persistent problems of practice from multiple stakeholders' perspectives.
2. To improve practice, teams commit to iterative, collaborative design.
3. To promote quality in the research and development process, teams develop theory related to both classroom learning and implementation through systematic inquiry.
4. Design-based implementation research is concerned with developing capacity for sustaining change in systems.

What is iHub?

- A project funded by the National Science Foundation and the Moore Foundation.
 - To design and study digital curriculum materials that can help teachers implement new standards.



What is iHub?

- A long-term partnership of Denver Public Schools, UCAR, CU Boulder, and BSCS
 - We work on district challenges together, applying what we know from research to develop solutions collaboratively.



Discover a World
of Opportunity™



How We Decide Focus of Joint Work

Teams form around a focus on persistent problems of practice from multiple stakeholders' perspectives.

- Proposal stage:
 - District: Need for a “deeply digital” curriculum that is open access and student-centered
 - BSCS: Desire to update *Green* version of ninth grade biology curriculum
 - CU/UCAR: Desire to continue research and development on a digital platform, the Curriculum and Customization Service

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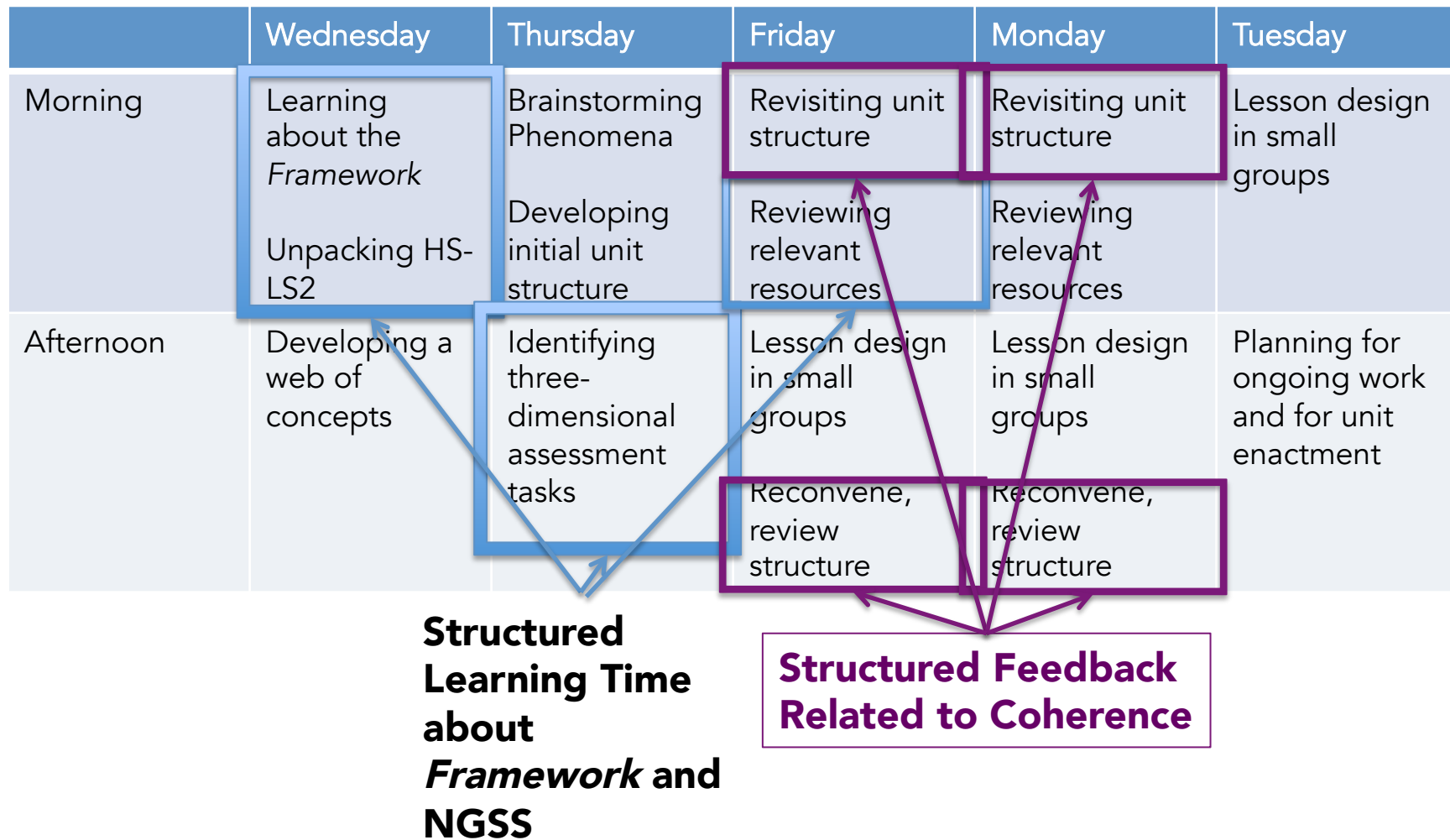
- We periodically *re-negotiate* the focus of joint work through:
 - Weekly meetings
 - Semi-annual half-day retreats between university researchers and district leaders

Organizing Collaborative Design

To improve practice, teams commit to iterative, collaborative design.

- Our partnership is *multi-tiered* (Severance, Leary, and Johnson)
 - Leadership: District leaders and researchers
 - Research: Researchers, curriculum developers, software developers
 - Design team: Everyone

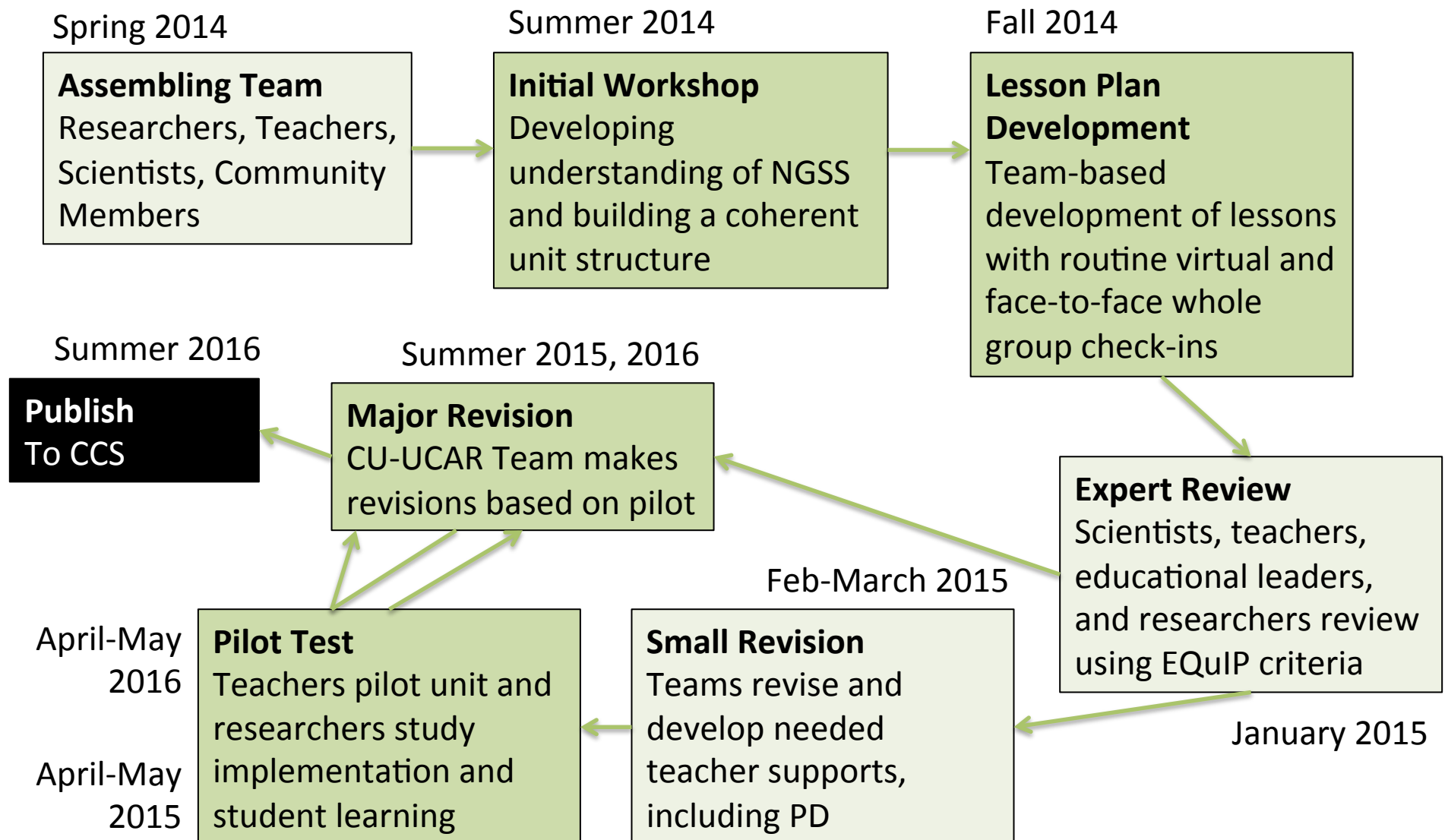
Organization of Initial Workshop



Supporting Coherence

Student Phase of Investigation Cycle/"Cascade of Practices"	Lesson Number	Driving Question	What Students Will Figure Out	(What Students DO/Science and Engineering Practice)	What the Phenomenon Is
Define Overarching Unit Question	1.1	Why should we care about trees?	Things that they know already and need to figure out to solve the challenge; Benefits of trees to people that are a priority to the class that they want to maximize to solve the challenge	Students ask questions related to the possible impacts of planting trees to modify the environment; Students further define the engineering problem by identifying reasons why they care about trees and relate them to the challenge.	<i>Cities are ecosystems where human activity is constantly modifying the environment, such as through building and construction, redirecting waterways, and consumption of energy for cars, heating, and cooling.</i>
Define Question/Problem	1.2	What effect do trees have on the air temperature around us?	Cities are much hotter than surrounding areas, and the pattern on maps shown at the regional and neighborhood scale shows that where there are more buildings, it's hotter, while where there are more trees, the temperature is cooler.	Students analyze data from graphs and maps to identify land cover patterns associated with the Urban Heat Island effect.	THE "URBAN HEAT ISLAND" PATTERNS OF HEAT/COOL ARE OBSERVABLE AT NEIGHBORHOOD AND REGIONAL LEVEL LEVEL
Plan and Carry Out Investigation	1.3	Why is it cooler where there are trees than where there are buildings and roads?		Students plan and carry out an investigation of effects of different surfaces on temperature in the classroom	
Analyze Data	1.3		Trees cool the air in part by reducing the amount of sunlight striking buildings and pavement, which reduces the amount of energy that is absorbed and re-radiated into the air.	Students formulate claims about which trees provide the most data, backed by evidence from observations, and warrant them by their method of observation.	
		How does water from trees help cool the air?	Trees can cool the air through the process of evapotranspiration	Students plan and carry out an investigation of effects of evapotranspiration on	

Iterative Design Process



Developing Evidence to Inform Design

Teams develop theory related to both classroom learning and implementation through systematic inquiry.

Research Question	Sources of Evidence
How do teachers in the collaborative design process engage with the ideas in the <i>Framework for K-12 Science Education</i> ?	Field notes of collaborative design process Informal interviews Surveys of teachers' experience of the design process and recommendations for improvement
How well do the materials teachers design reflect the vision and principles of the <i>Framework</i> ?	External reviews using a rubric (adapted from Achieve's EQUIP rubric)
How do teachers' adapt the materials as they implement them?	Post-enactment reflections Observations
How does student learning in design teachers' classroom compare to student learning in similar classrooms?	Extended tasks designed for the district's interim assessments

Theories of Implementation

- Sensemaking theory (Weick, 1995)
 - Focuses on how local actors (e.g., teachers) go about making sense of uncertainty and confusion from conflicting messages in their organizational environment
- How it has informed design
 - Inclusion of specific activities to surface conflicting messages teachers experience periodically throughout design with district leaders present

Building Capacity

Design-based implementation research is concerned with developing capacity for sustaining change in systems.

- Focus is on capacity of the partnership to get better at improvement (following the idea of a *networked improvement community*)
- At present, we are focused mainly on:
 - Using what we learn from perspectives on design to improve efficiency of materials development

Building Capacity for DBIR

- Graduate education
 - Within educational leadership programs
 - Within teacher education programs
 - Within learning sciences programs
- Building practical “tools of the trade” for research-practice partnerships
 - Organizing collaborative design
 - Developing and using implementation evidence



RESEARCH + PRACTICE
COLLABORATORY



Thank You

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In print:

Fishman, B. J., Penuel, W. R., Allen, A.-R., & Cheng, B. H. (Eds.). (2013). *Design-based implementation research: Theories, methods, and exemplars*. National Society for the Study of Education Yearbook. New York, NY: Teachers College Press.

Penuel, W. R., Fishman, B. J., Cheng, B., & Sabelli, N. (2011). Organizing research and development at the intersection of learning, implementation, and design. *Educational Researcher*, 40(7), 331-337.

DBIR Summer Workshop

Boulder, CO

July 16-18, 2015

To register:

<http://learndbir.org/workshop>