A Research-Practice Partnership to Design New NGSS Curriculum

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### Agenda for Today

<table>
<thead>
<tr>
<th>TIME ALLOCATED</th>
<th>ACTIVITY</th>
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<tbody>
<tr>
<td>20 min</td>
<td>Introduction to iHub</td>
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<tr>
<td>1 hour 20 min</td>
<td>Co-design Activity using Challenge Cycle</td>
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<tr>
<td>20 min</td>
<td>Tools for Curriculum Design</td>
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<tr>
<td>1 hour 30 min</td>
<td>LUNCH</td>
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<td>30 min</td>
<td>Posing Questions, Planning Investigations</td>
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<td>30 min</td>
<td>Academically Productive Talk</td>
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<td>30 min</td>
<td>Know Who, Know How</td>
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Goals for Today

At the conclusion of this session, participants will be prepared to:

• **Identify expertise** in their local area needed to design or adapt curricula that is aligned to NGSS

• **Organize a design process** that includes teachers and that results in a coherent sequence of instructional experiences for students

• **Lead activities** that simultaneously develop teachers’ understanding of NGSS and new instructional materials
Overview of iHub Biology

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What is iHub?

A project funded by the National Science 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
How the Partnership Supports DPS

DPS wishes to replace its aging high school biology curriculum with a new curriculum that:

- Embodies the vision of the *Framework for K-12 Science Education*
- Meets the goals of the Next Generation Science Standards and Colorado Academic Standards
- Is deeply digital for both students and teachers
- Builds on the strengths of a multi-year research-practice partnership
Primary Guide: The *Framework*
Key Principles

• **Integrated** science learning, not separate activities focused on teaching content or science processes

• Knowledge builds through **science and engineering practices**: Ask, “Is [verb in the objectives statement] a practice?”

• “**Engage me**” versus “trust me” instruction; guided inquiry toward learning goals

• Anchored in **phenomena** to be modeled and explained
“Alignment of teacher preparation and professional development with the vision of science education advanced in this framework is essential for eventual widespread implementation of the type of instruction that will be needed for students to achieve the standards based on it.” (NRC, 2012, p. 256)
Our Initial Strategy: Co-Designing Curriculum with Teachers

<table>
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<tr>
<th>What Is It?</th>
<th>Teachers collaboratively design coherent sequences of curriculum with scientists, curriculum experts, and learning scientists</th>
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| How It Supports Shifts in Framework              | Focusing on a few disciplinary core ideas and crosscutting concepts  
Engaging students in scientific and engineering practices |
| Challenge/Condition Addressed                    | Lack of curriculum materials aligned to the Framework  
Building common understanding of the key shifts in the Framework |
We are collaboratively re-designing the biology curriculum, one unit at a time, beginning with ecosystems.

Each unit is anchored in phenomenon around NGSS life sciences disciplinary core ideas:
- HS-LS1 From Molecules to Organisms
- HS-LS2 Ecosystems
- HS-LS3 Heredity
- HS-LS4 Biological Evolution
Units and Timeline for Development

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<th>2016-17</th>
<th>2017-18</th>
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- Ecosystems: Interactions, Energy, and Dynamics
- Biological Evolution: Unity and Diversity
- Heredity: Variation of Traits
- From Molecules to Organisms: Structures and Processes
Iterative Design Process

**Assembling Team**
Researchers, Teachers, Scientists, Community Members

**Initial Workshop**
Developing understanding of NGSS and building a coherent unit structure

**Lesson Plan Development**
Team-based development of lessons with routine virtual and face-to-face whole group check-ins

**Major Revision**
CU-UCAR Team makes revisions based on pilot

**Small Revision**
Teams revise and develop needed teacher supports, including PD

**Expert Review**
Scientists, teachers, educational leaders, and researchers review using EQuIP criteria

**Pilot Test**
Teachers pilot unit and researchers study implementation and student learning

**Spring 2014**

**Fall 2014**

**Summer 2015, 2016**

**Publish To CCS**

**Spring 2016**

**April-May 2015**

**February-March 2015**

**January 2015**

**April-May 2016**
How We Are Organized

- Four teams, each responsible for two weeks of lessons
- Teams are linked by something called a “Storyline” diagram (explained later)
- We need new external partners and teachers in each team to
  - Contribute ideas to how to make a clear storyline that builds toward our goal for students
  - Contribute ideas and insights from science about ecosystem dynamics and other ecosystems we might study
Later: Tools Guiding Our Work

• Challenge Cycle for Unit Development
  – What phenomena intersect with students’ interest and NGSS PEs?

• Storyline Diagram
  – How will we build a coherent unit around the phenomena?

• Student Cascade of Practices
  – How can we optimally sequence practices in exploring the phenomenon?
Let’s find out who’s here

• Each square on the Bingo Card has a skill or experience of someone in the room
• Find people with the skills and life experience represented on your card and put their name in those squares
• When you have completed a row, column, or diagonal, yell Bingo!
• When you win, you’ll be asked to introduce the people on your completed row, column, or diagonal
• We’ll keep playing until everyone’s been introduced at least once