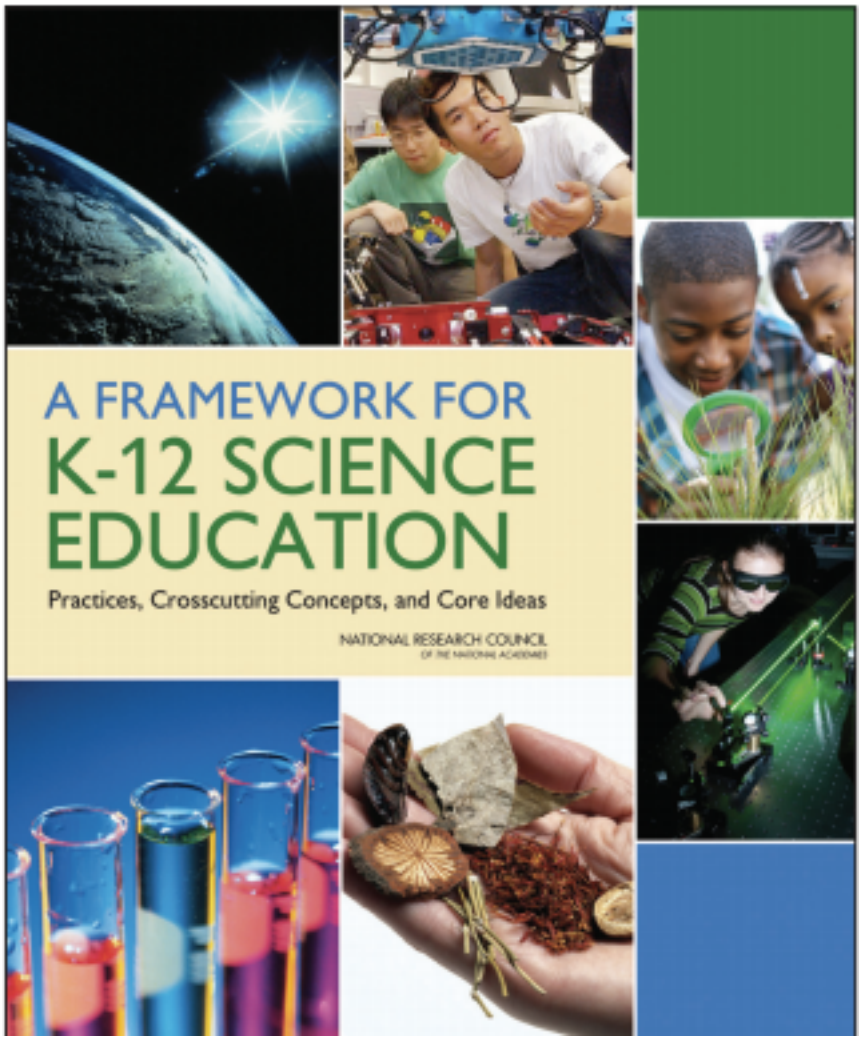
Getting to scale with new visions of teaching and learning

William R. Penuel
University of Colorado Boulder
@bpenuel
@learnDBIR
@NCRPP

RESEARCH + PRACTICE COLLABORATORY



Integration of content, practices, and crosscutting concepts

Understanding develops over time

Connecting to interests and experiences

Promoting equity

Design aligned curriculum materials and needed supports for implementation.

Involve educators, district leaders, and people with experience related to the vision.

Researchers and educators should stay engaged to support implementation in long-term partnerships.

Inquiry Hub


DENVER
PUBLIC
SCHOOLS
Discover a World
of Opportunity™


UCAR
UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH


BSCS


NSF


GORDON AND BETTY
MOORE
FOUNDATION

Spread

Digital curriculum platform used by district teachers in middle and high school Earth science, algebra, and mathematics

Adopted by Clark County School District

Evidence of Impact

Platform usage and student learning

(*r* = 0.22-0.27)

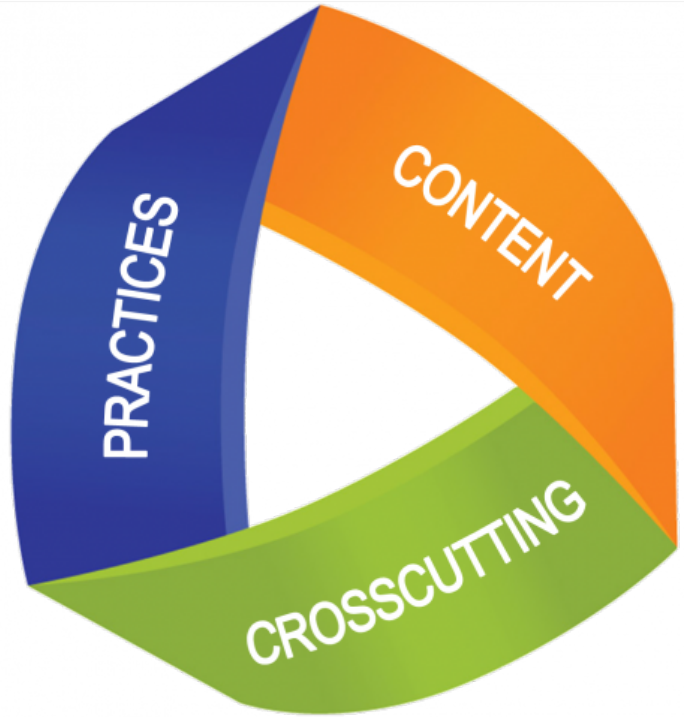
Comparison group study of assessment intervention (+0.25 ≤*d* ≤ +0.45)

1 Design aligned curriculum materials and needed supports for implementation.

Grounded in how students learn science

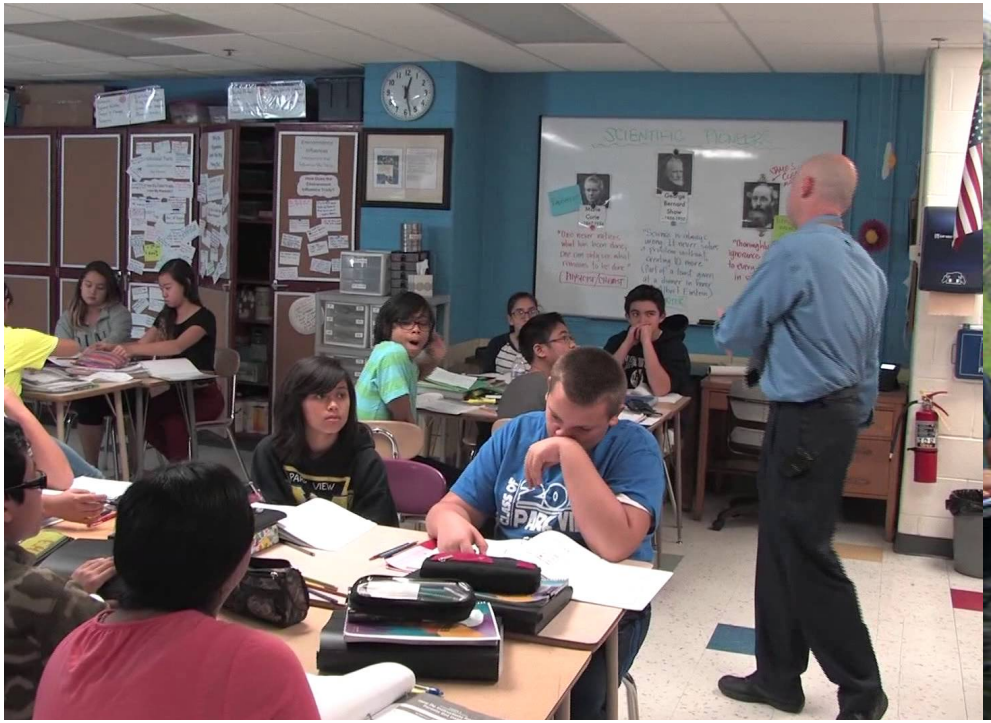
Presents significant learning demands

Anchor for designing classroom learning environments

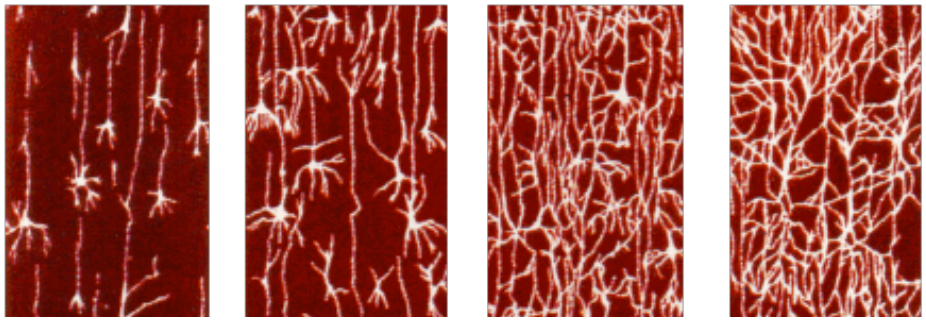


DBIR Element 3:
A concern with **developing theory and knowledge related to both classroom learning** and implementation through systematic inquiry

What designed experiences support students' three-dimensional science learning over time?

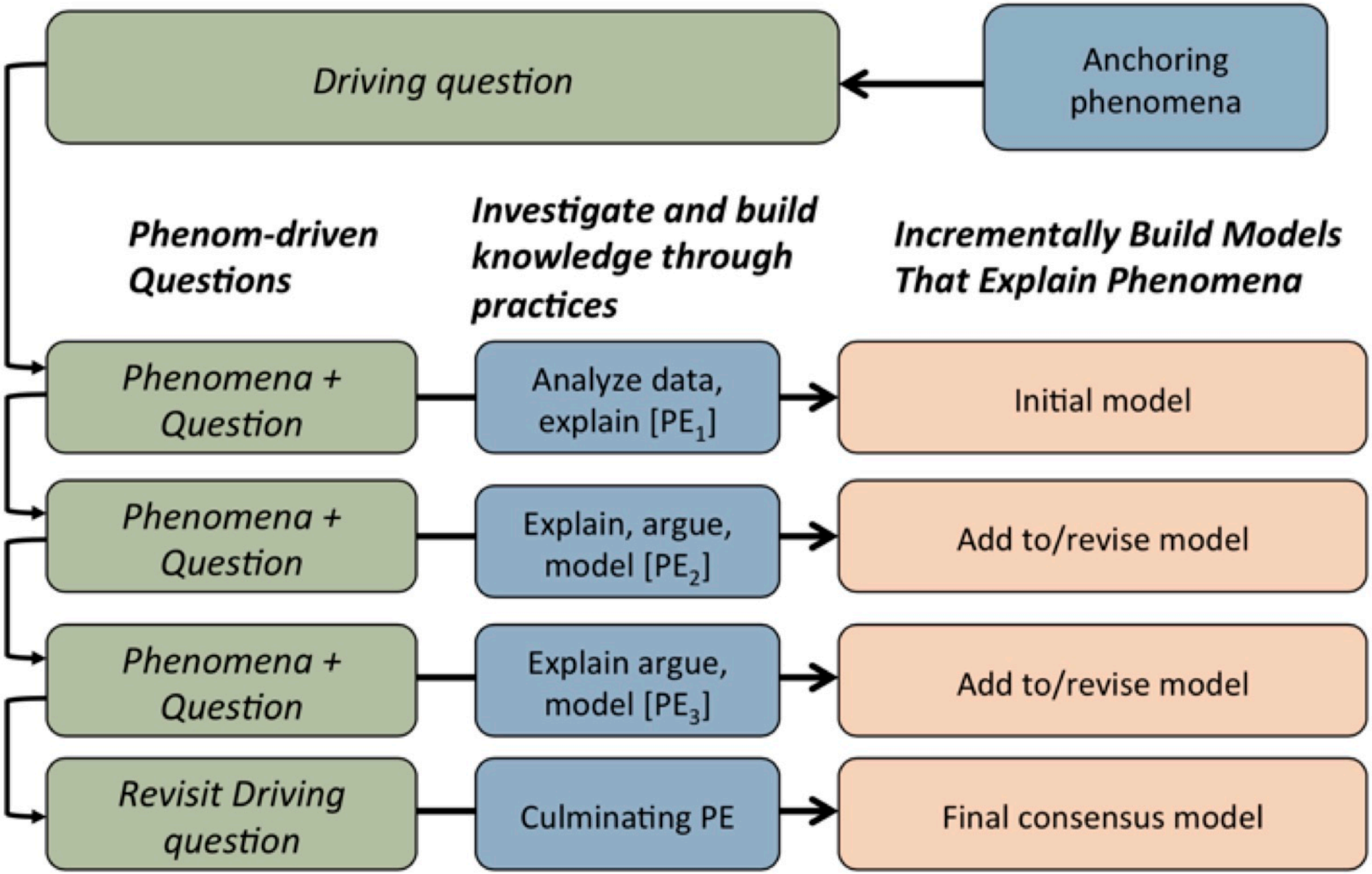


Developmental Coherence



Our Conjecture:

Coherent, designed sequences of instructional experiences are key supports for learning



From Reiser (2013)

Organization of Initial Workshop

	Wednesday	Thursday	Friday	Monday	Tuesday
Morning	Learning about the *Framework* Unpacking HS-LS2	Brainstorming Phenomena Developing initial unit structure	Revisiting unit structure Reviewing relevant resources	Revisiting unit structure Reviewing relevant resources	Lesson design in small groups
Afternoon	Developing a web of concepts	Identifying three-dimensional assessment tasks	Lesson design in small groups Reconvene, review structure	Lesson design in small groups Reconvene, review structure	Planning for ongoing work and for unit enactment

Structured Learning Time about *Framework* and NGSS

Structured Feedback Related to Coherence

Our Conjecture:

Broad implementation will depend on perceived levels of vertical and horizontal coherence in system

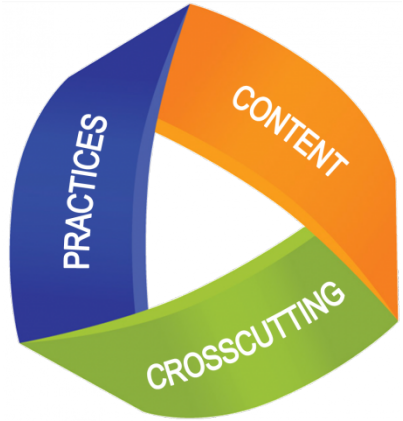
Vertical and Horizontal Coherence

District leaders

School leaders

Teachers

Students



Curriculum

PD

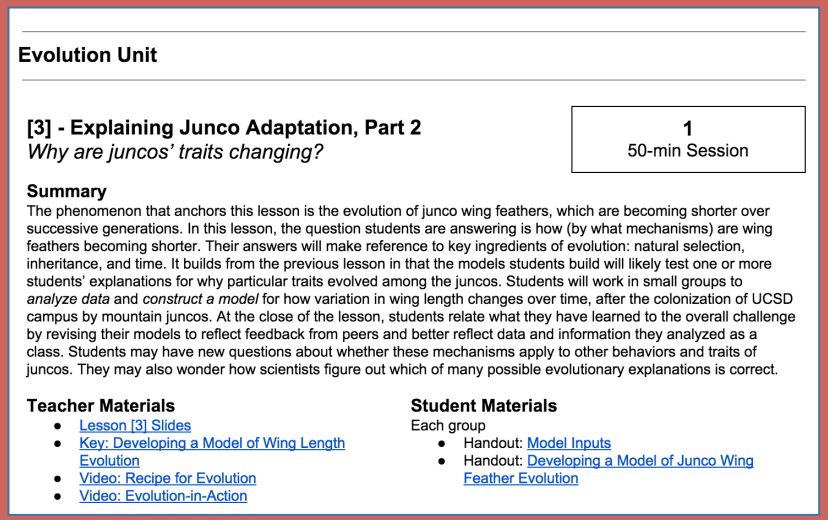
Pacing Guides

Assessment

Student Assessments

Professional Development

Curriculum Materials



Evolution Unit

[3] - Explaining Junco Adaptation, Part 2
Why are juncos' traits changing?

1
50-min Session

Summary
The phenomenon that anchors this lesson is the evolution of junco wing feathers, which are becoming shorter over successive generations. In this lesson, the question students are answering is how (by what mechanisms) are wing feathers becoming shorter. Their answers will make reference to key ingredients of evolution: natural selection, inheritance, and time. It builds from the previous lesson in that the models students build will likely test one or more students' explanations for why particular traits evolved among the juncos. Students will work in small groups to *analyze data* and *construct a model* for how variation in wing length changes over time, after the colonization of UCSD campus by mountain juncos. At the close of the lesson, students relate what they have learned to the overall challenge by revising their models to reflect feedback from peers and better reflect data and information they analyzed as a class. Students may have new questions about whether these mechanisms apply to other behaviors and traits of juncos. They may also wonder how scientists figure out which of many possible evolutionary explanations is correct.

Teacher Materials
- Lesson [3] Slides
- Key: Developing a Model of Wing Length Evolution
- Video: Recipe for Evolution
- Video: Evolution-in-Action

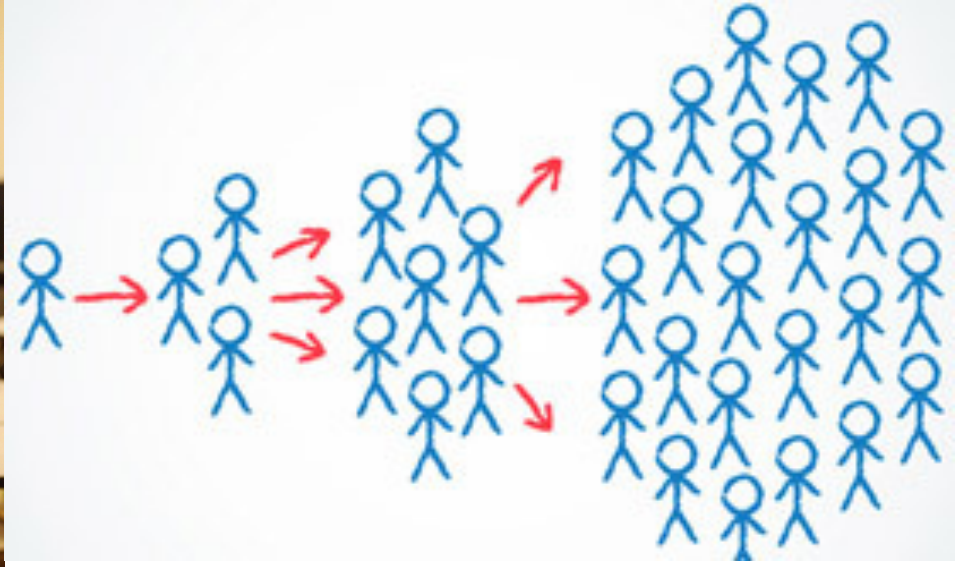
Student Materials
Each group
- Handout: Model Inputs
- Handout: Developing a Model of Junco Wing Feather Evolution

Leadership & Coaching

Pacing Guides

Curriculum + Coherent Infrastructure Promotes Scale

Cohen & Hill, 2001; Penuel, et al., 2011; Penuel, Harris, et al., 2015



Research Question:

Under what conditions do curricular experiences (1) connect to diverse students' interests and experiences and (2) improve learning?

DBIR Element 3:
A concern with **developing theory and knowledge related to** both classroom learning and **implementation** through systematic inquiry

Analyzing Connections to Diverse Interests

Practical Measure:

Meaningful to self, class, community

Lesson contributes to addressing challenge

Analyzing Student Learning

District Interim Assessments:

3D Science learning, designed by us

Multiple-choice, designed by other teachers

2 Involve educators, district leaders, and people with experience related to the vision.

2 Involve educators, district leaders, and people with experience related to the vision.

DBIR Element 1:
Focus is on **persistent problems of practice from multiple stakeholders' perspectives.**

DBIR Element 2:
Teams commit to **iterative, collaborative design.**

Why problems of practice?

If a problem is worth solving to multiple stakeholders, then people are more willing to commit to implementing collaboratively designed solutions.

Collaborative Design

Builds ownership

Produces usable, effective materials

Develops advocates for new materials

Coordinated Levels of Work in DBIR (Bell et al., 2015)

Traditional focus of design-based research and much innovation development

Coordinated Levels of Work in DBIR (Bell et al., 2015)

Implementation Support Level

Target Environment Level (Classroom)

Coordinated Levels of Work in DBIR (Bell et al., 2015)

Design Level

Implementation Support Level

Target Environment Level (Classroom)

Coordinated Levels of Work in DBIR (Bell et al., 2015)

Coordinated Levels of Work in DBIR (Bell et al., 2015)

3 Researchers and educators should stay engaged to support implementation in long-term partnerships.

3 Researchers and educators should stay engaged to support implementation in long-term partnerships.

DBIR Element 3:
A concern with **developing theory and knowledge related to both classroom learning and implementation** through systematic inquiry

DBIR Element 4:
A concern with **developing capacity for sustaining change in systems**

‘Transfer of Ownership’ at High Altitude

Partnership Work as *Team Rafting in Rapids*

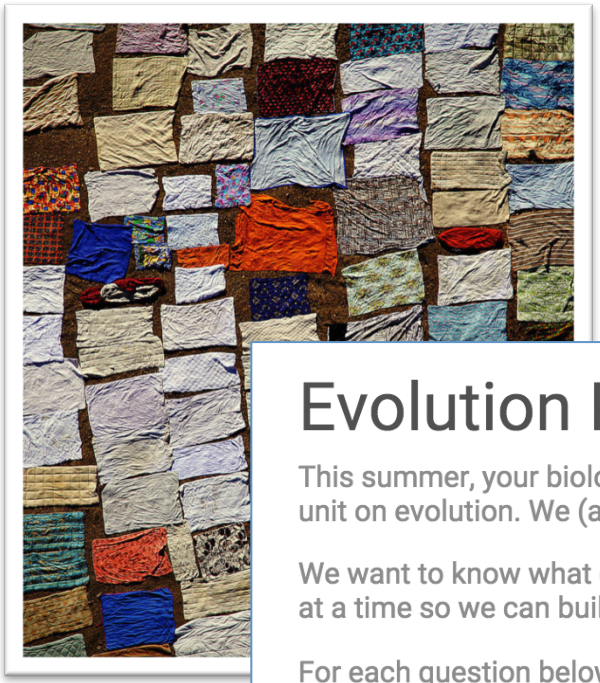
Partnership Foundations

- Knowledge of perspectives on problems
- Well-defined roles
- Knowledge of history and lines of authority
- Adequate resources

Henrick, Jackson, Cobb, Penuel (in progress)

Why Stay Involved?

- Implementation presents new design challenges
- Implementers invent solutions others can adapt
- Environments are turbulent (Peurach, Glazer)



“Patchwork Efforts”

Evolution Phenomena Student Survey

This summer, your biology teacher is going to be working with a team to design a new curriculum unit on evolution. We (a team of researchers and DPS teachers) want your ideas to shape the unit.

We want to know what questions and topics you find interesting enough to explore for 2-3 weeks at a time so we can build some awesome lessons over the summer.

For each question below, let us know how interesting you find the topic AND how much time you would like to spend investigating it.

1. How do some pests become resistant to insecticides?

For example, how do things like cockroaches become resistant to chemicals that are supposed to kill them?

	0	1	2	3	4	
Not at all interesting	○	○	○	○	○	Very Interesting

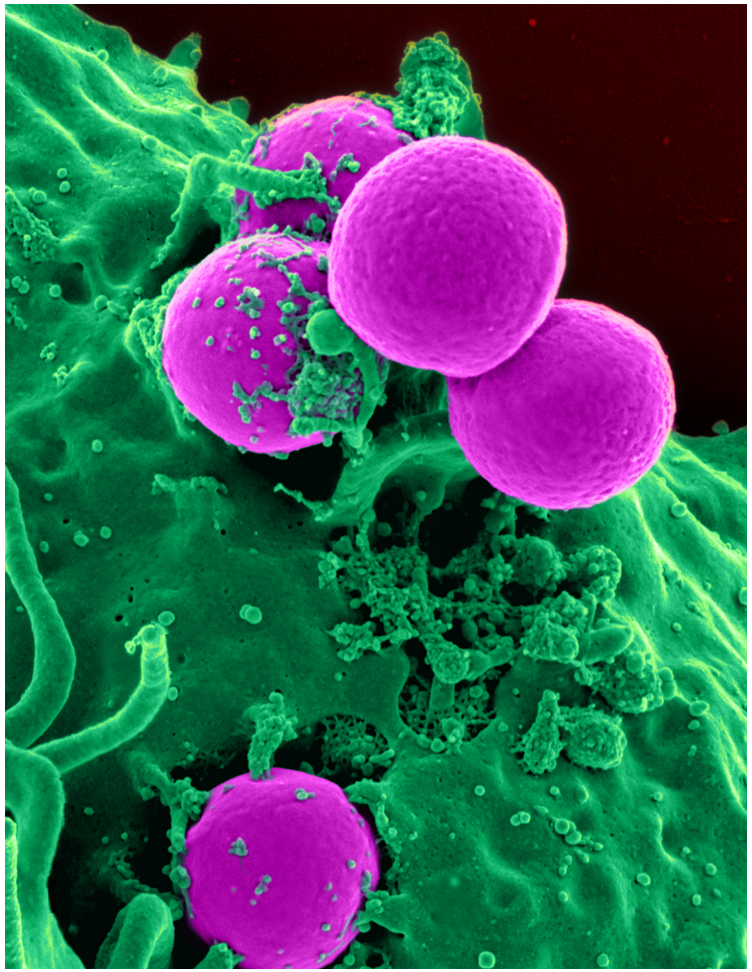
2. How do some bacteria become resistant to medicines developed to fight them?

For example, how come it's hard to treat MRSA? (Mark all that apply)

	0	1	2	3	4	
Not at all interesting	○	○	○	○	○	Very interesting

“Patchwork Efforts”

SUPERBUGS



What Travels and How?

"It's networks all the way down."

Professional associations

Collaborative design tools and routines

Partnerships

Tools and routines for organizing partnerships

RESEARCH + PRACTICE COLLABORATORY

Design curriculum materials and needed supports for implementation. (Element 1)

Involve educators, district leaders, and people with experience related to the vision. (Elements 1 and 2).

Researchers and educators should stay engaged to support implementation in long-term partnerships. (Elements 3 and 4)

Build infrastructure for spread by leveraging existing networks and developing new ones.

Take Action

- Set up a meeting in the next month:
  - With a new prospective partner
  - With a current partner
  - With a colleague who is engaged in partnership work
- Participate
  - In our RPP Forum Series beginning next week

Why DBIR?

Evolution Unit

[3] - Explaining Junco Adaptation, Part 2
Why are juncos' traits changing?

1
50-min Session

Summary

The phenomenon that anchors this lesson is the evolution of junco wing feathers, which are becoming shorter over successive generations. In this lesson, the question students are answering is how (by what mechanisms) are wing feathers becoming shorter. Their answers will make reference to key ingredients of evolution: natural selection, inheritance, and time. It builds from the previous lesson in that the models students build will likely test one or more students' explanations for why particular traits evolved among the juncos. Students will work in small groups to *analyze data* and *construct a model* for how variation in wing length changes over time, after the colonization of UCSD campus by mountain juncos. At the close of the lesson, students relate what they have learned to the overall challenge by revising their models to reflect feedback from peers and better reflect data and information they analyzed as a class. Students may have new questions about whether these mechanisms apply to other behaviors and traits of juncos. They may also wonder how scientists figure out which of many

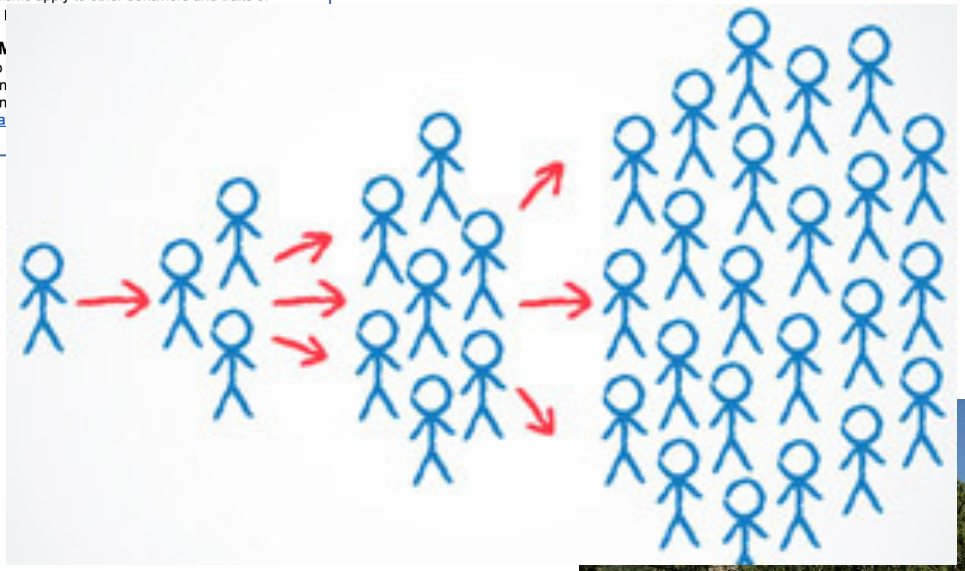
Teacher Materials

- Lesson [3] Slides
- Key: Developing a Model of Wing Length Evolution
- Video: Recipe for Evolution
- Video: Evolution-in-Action

Student M

Each group

- Han
- Han
  Fea



Learn More

RESEARCH + PRACTICE COLLABORATORY

Participate
R+P Collaboratory's
Research-Practice Partnership Forum
http:/bit.ly/RPPForum

Attend
Design-Based Implementation Research Workshop
July 21-22, 2016
http://learndbir.org/workshop

Visit
http://researchandpractice.org
http://learndbir.org

Interact
@learnDBIR, @RPCollaboratory

The District's Perspective

- Not willing to adopt a new textbook
- *Prefers rapid development*
- **Wants process that builds teacher understanding**

DENVER PUBLIC SCHOOLS

Discover a World of Opportunity™

Impact: TIDES Study

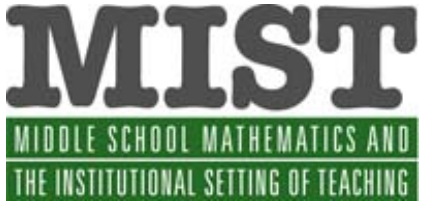
- Impact of preparing teachers to adapt high-quality curriculum materials on:
  - **Assignment quality: +0.70**
  - **Student learning: +0.29**

A Family of Approaches

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

"improvement science"

"problem-solving research, development, and implementation"



"designing for improvement at scale"

Matching Phase of Development to Phase of Research

Phase of Development	Driving Questions	Sources of Evidence
Problem Negotiation	What problem of practice should be the focus of our joint work?	Available data from multiple sectors Research evidence Perspectives and values of stakeholders (including nonschool actors)
Co-design	What should be the focus of our work? To what extent do teams leverage the diverse expertise of stakeholders?	Design Rationales Ethnographic accounts of design processes

Matching Phase of Development to Phase of Research

Phase of Development	Driving Questions	Sources of Evidence
Early implementation	How do implementers adapt the innovation to their local contexts? How do implementers use the innovation to reconstruct their practice? What are the appropriate measures of impact?	Observations of implementation Interviews Assessment design
Efficacy	What is the potential impact of the innovation on teaching and learning? What mediates impacts on learning?	Randomized Controlled Trials Interrupted Time Series Designs Explanatory Case Studies

Matching Phase of Development to Phase of Research

Phase of Development	Driving Questions	Sources of Evidence
"Translation"	What supports are needed to implement the program effectively? What are the conditions for sustainability?	Experimental comparisons of different means of support Explanatory comparative case analysis