PAGES: Creating Collaborations across Communities
A central role for curriculum

Barbara Hug
University of Illinois, Urbana Champaign
College of Education
“….gift to each child in the world be a sense of wonder so indestructible that it would last throughout life, as an unfailing antidote against the boredom and disenchantments of later years, the sterile preoccupation with things that are artificial, the alienation from the sources of our strength.

If a child is to keep alive his inborn sense of wonder without any such gift from the fairies, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in.”
Rationale for PAGES

- Promote greater science literacy around “controversial” topics
  - Evolution
  - Climate change and its implications
  - Intersection of these two core ideas

- Productive cognitive dissonance about decisions we make

- Part of larger effort focused on science teaching and learning
  - Supporting teachers in the shifts asked for by the Next Generation Science Standards
  - Attending to changing student populations
Create explicit links between University and K-12 education contexts to address the needs of students by collaboratively working with:

- Teachers
  - Preservice
  - Inservice
- Scientists
- Science educators
Why collaboration?

- The practice of science is collaborative
  - Scientific community is a specialized community that speaks a common language and shares common goals
  - Diverse expertise can be essential and valued

- Teaching can also be thought of as a collaborative activity
  - Teachers of all types: K-12; university
  - Students
  - Community organizations

- Learning is a collaborative effort between teachers and students
  - The new standards are asking for a shift from learning about science to “figuring out”.
  - Formation of a community of learners is key to this process
A question that needs to be considered is how to support the development or creation of the space necessary for this community of learners.

- Curriculum development and implementation

Wenger defines a community of practice as “a group of people who share a concern or a passion for something they do, and learn how to do it better as they interact regularly.”

What can we learn by examining curriculum development and enactment using this framework?

- Foregrounds the social interactive processes by which learning occurs.
- Allows us to think about learning both in terms of learning about science and learning about teaching.
What is a Community of Practice? (Wenger 2011)

Three key parts: the domain community, and practice

The **domain**:
- “A community of practice...has an identity defined by a shared domain of interest.”

The **community**:
- “...members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other.”
What is a community of practice? (Wenger 2011)

The practice:

- “A community of practice is not merely a community of interest... Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short a shared practice. This takes time and sustained interaction.”
  
  ○ Shared practice focused on teaching
Questions

In PAGES, we initially identified a Domain, brought together individuals to form a Community, and provided scaffolds for Practices focused around NGSS aligned curriculum/teaching to be established.

- How were different aspects of a CoP established (or not) and modified (or not) over time?
- Looking to the future, which of these community models are "sustainable," and in what ways?
Progressing through the Ages: Global change, Evolution, and Societal well-being

- Collaborative project between Carl Woese Institute of Genomic Biology, College of Liberal Arts and Science and College of Education
- Next Generation Science Standards (NGSS)-aligned curriculum development
- K–12 teacher education program.
- Funded through a Science Education Partnership Award from the NIH
- Awarded in 2016; just finishing the 3rd year of a 5 year grant
Table 4: Learning progressions (LP), Disciplinary Core Ideas (DCI), and Component Ideas for individual units.

<table>
<thead>
<tr>
<th>LP Themes</th>
<th>Disciplinary Core Ideas</th>
<th>Component Ideas individual units will focus on</th>
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| LP1: Range shifts, novel ecological interactions, vector-borne disease, and evolution | LS 2: Ecosystems  
LS 4: Evolution  
ES 3: Earth and Human Activity | LS2.A: Interdependent relationships in ecosystems  
LS2.C: Ecosystem dynamics, functioning and resilience  
LS4.C: Natural Selection  
LS4.D: Biodiversity and humans  
ESS3.D: Global climate change |
| LP2: Phenotypic variation and development: genetics, plasticity, and evolution | LS 1: Molecules to Organisms  
LS 3: Heredity  
LS 4: Evolution  
ES 3: Earth and Human Activity | LS1. B: Growth and development of organisms  
LS3.A Inheritance of traits  
LS3.B: Variation of traits  
LS4.B: Adaptation  
ESS3.D: Global climate change |
**Preparation**
- **Curriculum Developers:** Propose LPs
- Prep. avail NGSX material
- Recruit teachers
- **Researchers/Evaluators:** Develop instruments

**Institutes**
- **Teacher Teams & Solo:**
  - Gain knowledge of NGSS
  - Generate curr. ideas
  - Give implement feedback
- **Curriculum Developers:**
  - Gain ideas for curriculum
  - Implement NGSX (PD)
- **Scientists:**
  - Introduce sci concepts

**Dynamic Curriculum Development (NGSS-aligned LPs)**
- **Teacher Participants:**
  - Develop/Give feedback
- **Curriculum Developers:**
  - Design/revise lessons
- **Scientists:**
  - Critique science content

**Dissemination**
- **Teacher Teams:**
  - District integration of LPs
- **Curriculum Developers:**
  - LPs on project website
  - NGSX materials
  - Research/PD conferences
  - Collaboration w/ projects
- **Researchers/Evaluators:**
  - Write reports
  - Publish journal articles

**Research**
- **Researchers/Evaluators:**
  - Revise instruments
  - Collect & analyze data

**NGSX Development**
- **Curriculum/NGSX Developers:**
  - Design/revise PD

**Classrooms**
- **Teacher Teams & Solo:**
  - Implement curriculum
- **Curriculum Developers:**
  - Observe enactments
  - Record video for NGSX
Where are we in the development process?

- Units under development

  - How do we all grow up? (Year 1)
    - Elementary Life Cycle/Inheritance (3-LS1-1, 3-LS3-1)
  - How do eggs become chickens or other living things?
    - Middle School Cell Biology, Embryology and Developmental Biology (MS-LS4-3, MS-LS1-1, MS-LS1-3, MS-LS1-2)
  - Why are dogs getting sick?
    - Middle School Ecology Unit/Climate Change (MS-LS2-2, MS-LS2-4, MS-ESS-3-2)
  - Why aren’t kids the exact same as their parents?
    - Middle School Genetics, Sexual and Asexual reproduction MS-LS3-1, MS-LS3-2, MS-LS4-5)
Where are we in the development process?

- Units under development
  - Why are these kids getting sick and how can I (and other kids) avoid getting sick?
    - High School Ecosystem/Disease vector, HS-LS2-1, HS-LS2-2, HS-LS2-6, HS-LS2-7, HS-LS4-6
  - Why are males so showy?
    - High School Animal Communication, HS-LS2-8, HS-LS3-3, HS-LS4-2, HS-LS4-3, HS-LS4-4

- Have piloted all units, some in more classrooms than others
  - Most units have classroom level data collected; currently being analyzed

- Teacher Institutes: currently planning Year 4 summer
What can we learn from the project?

- Looking across three years of data, what have we learned regarding the creation and development of CoPs focused broadly on an end goal of classroom instruction?
  - Field notes and observations across Years 1-3
  - Teacher surveys: pre/post workshop and pre/post unit enactment
  - Teacher and University project personnel interviews
Preliminary Findings Summary

- The use of curriculum was a major organizing factor of different communities of practice:
  - CoP around curriculum development
  - CoP around curriculum enactment

- While multiple communities of practice emerged from the larger project around these two areas, not all were as strong

- Creation and maintenance of these communities is difficult
CoP around curriculum development

- *Unit specific* communities of practice were created around the curriculum development process
  - Ownership of the development matters across all three areas of a CoP
  - Domain: Focus of the (sub) domain shifted and took time to establish
  - Communities benefited from a range of experience and expertise
  - Practice: Meetings among members important; shared understanding of the practice was key
Role of Ownership

- Ownership in the development process (domain) matters
  - Need to see purpose and use of the materials as well
  - Owning of mistakes
  - Allowing the domain or focus of domain to shift

One of the Heartworm teachers: “Barbara made me feel better in the second summer when she said that she had screwed up, that she had just assigned us [standards]...I didn’t come out of ... [the 2016 workshop with anything].. that I literally applied to my classroom...Learning how to walk through a unit, I still took that out, but ...it was not until the next summer [2017] when we sat down and said ‘What can we actually do that is going to be good for your curriculum?’”
Role of Ownership

- Members have equal ownership/responsibility within the community
  - Importance of valuing contributions of members
  - Members came and left for range of reasons

- Strong CoPs had all members developing curriculum, not just providing feedback
  - Different roles still possible based on expertise

- Shift in collaboration and development process pre NGSS to after NGSS adoption (practice)
  - Top down vs more collaborative curriculum development model
Community: Range of experience and expertise

- Space for wide range of experience
- Provided opportunities for teacher growth (preservice → inservice)
  - Four of the PAGES teachers (3 Chicken and 1 Heartworm) had been preservice teachers the year before joining PAGES
  - Two of the inservice teachers worked with one of the 1st year teachers to mentor her in teaching
- Provided opportunities for growth of knowledge
  - Science content and knowledge of NGSS
With a range of expertise, multiple aspects of curriculum development were addressed (i.e., expertise in science content, establishing classroom norms, assessment, and other NGSS shifts).
Practice: Role of Group Meetings

- Meetings among members important
  - Multiple meetings, not just the summer
  - Face-to-face
  - Video conference
- Norms of the community
- Curriculum development/revision

One of the Chicken teachers: “...the summers are great because we are seeing each other face-to-face and pushing back and discussing [the unit] .... We do our best to stay connected so that we can stay together...when the school year starts. It’s to be expected. It’s tough...I’m thankful for the video calls that we had – because we were creating materials. That was a day-to-day thing. There were the video calls-- Only natural and it does provide some support.”
CoP around curriculum enactment

- *Unit specific* communities of practice developed around the enactment of specific curriculum materials
  - Domain was focused from the start
  - Community: Importance of honoring different roles respectfully
  - Practices: Meetings, different types as needed (eg video study group)
  - Allowed connections to other teacher groups
Importance of honoring different roles

- Importance of honoring different roles; treating as equals
  - Curriculum development, classroom enactment, PD facilitator teachers
    - Some teachers had all three of these teacher roles or some combination
    - Roles often assumed as needed
    - Mentoring at all levels
  - Enactment teachers at times assumed curriculum development role
    - Provided critical feedback and suggestions based on their context
      - Addition of formative assessment; additional supports for independent research during the heartworm unit
  - University science educators and scientists
Role of Virtual Study Group

- Just in time PD
  - Teachers who participated were more successful in the enactment
  - Sharing of classroom stories and artifacts

- Allowed different types of questions to be asked:
  - Central to the Chicken unit due to questions around living organisms

- Different teachers assumed different roles based on expertise

- Allowed connections to develop across teachers (near and far)

- Teachers participated as they could--watched the posted recording if needed
Building connections

- CoP around enactments allowed connections between CoPs and to new teacher groups
  - Within the PAGES CoPs
  - Iowa teachers and Illinois teacher CoP
  - ISTA networks and conferences

- Possible opportunity for dissemination of materials?
Discussion and implications

- Strong (emergent) communities formed around specific units and individuals

- Formation of communities takes time and effort
  - Developed over the three years

- Strong CoP strengthened curriculum development
  - Greater buy-in across the community
  - Units aligned more closely to the intent of the new standards

- CoP around enactment strengthened teaching by the individual teachers
  - Greater teacher buy in both from the original development CoP and new members to the enactment CoP: importance of seeing a full cycle
  - More authentic enactment based off of teacher feedback
  - Greater use and dissemination
Next steps

- Need to look to the classroom data and see if the end goal was accomplished; what type of learning environments were established?

- Figuring out how to sustain the CoP that have been established and expand for other teachers.

- Need to go beyond the preliminary findings and more clearly identify what supported (or not) the different CoPs so that the lessons learned can be used moving forward.
Questions?

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Barbara Hug
bhug@illinois.edu
@ImpactSciEd

PAGES: http://pages.illinois.edu