Implementing a learning progression-based educational system at large scales

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Carbon: Transformations in Matter and Energy

Carbon TIME

Overview

We use design-based implementation research and a social network frame to develop sustained implementation networks for an environmental literacy learning progression-based system. We highlight how network designs maximize dimensions shown to be important to scale and sustain innovations in education (Coburn, Russell, Kaufman, & Stein, 2012): *expertise* (the presence of people in the network who have mastered essential knowledge and practices), *strength of ties* (members of networks need strong personal and professional ties), and *depth of interactions* (teachers need to focus on core practices in their work together).

Network structure & activities

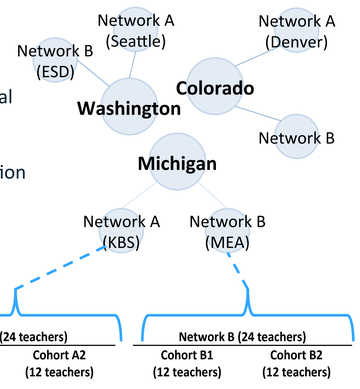
We are currently establishing 6 networks across 3 states. Each network is led by a team spanning organizational boundaries, with a researcher, an LEA administrator, and a teacher leader.

Sites

Washington
- Seattle region
- Statewide Educational Service Districts

Michigan
- Kellog Biological Station
- Michigan Education Association

Colorado
- Denver region
- TBD

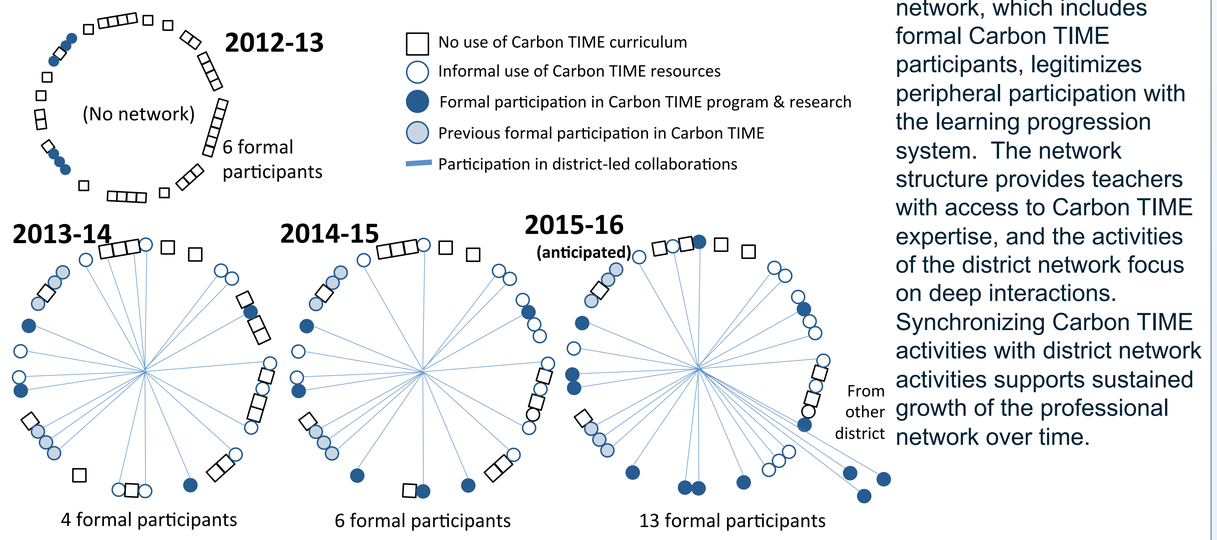


Year 1 (2014-5)	Organize			
Year 2 (2015-6)	First Year	Organize	Organize	
Year 3 (2016-7)	Second Year	First Year	First Year	Organize
Year 4 (2017-8)	Follow-up	Second Year	Second Year	First Year
Year 5 (2018-9)	Follow-up	Follow-up	Follow-up	Second Year

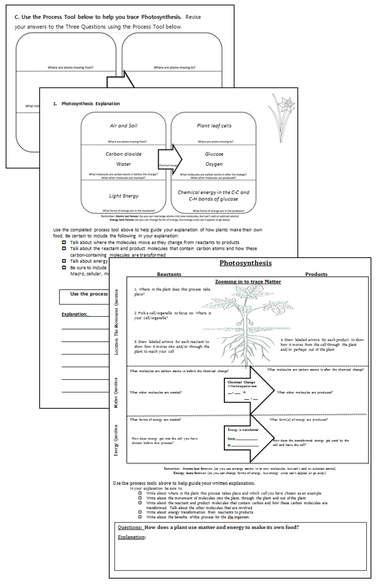
Time	*Activity*	*Description*
Organize	Design cohort-specific program	Three network leaders (staff leader, LEA leader, teacher leader) work with LEA administrators to (a) align plans with LEA policies and programs, (b) select or recruit teachers, and (c) select appropriate *Carbon TIME* units.
	Baseline data collection	In spring of the organizing year teachers will (a) administer student tests to one class (25 students) and (b) take the teacher assessment
1st Year Summer	Online course work	About 2 days of online work, including (a) for modeling and coaching responsive and rigorous teaching and (b) teaching specific units
	Face-to-face workshops	2 days during the summer, including (a) alignment of *Carbon TIME* and LEA policies, (b) rehearsing core practices, (c) analysis of baseline student responses, and (d) forming professional learning communities.
1st Year Schl Yr	Continuing support for teachers	About 1 day of online work and 1 day of in-person meetings, sharing and analyzing experiences and artifacts from teaching
	Data collection	Overall pre-post and unit assessments for at least one class (25 students); reports on classroom practices shared online
2nd Year Summer	Continuing support for teachers	About 1 day online and 1 day face-to-face, sharing data from Year 1 experiences, revising for Year 2. Teachers select areas of emphasis for Year 2 and retake the teacher assessment.
2nd Year Schl Yr	Continuing support for teachers	About 1 day of online work and 1 day of in-person meetings, sharing and analyzing experiences and artifacts from teaching
	Data collection	Overall pre-post and unit assessments for at least one class (25 students); reports on classroom practices shared online, final teacher assessment
Follow-up	Data collection	Collect data on continuing practice from subset of teachers

Development of one implementation network in an urban district

The figure below represents development of an implementation network in one urban school district, highlighting important network features. The nodes (circles and squares) arranged in a ring represent all Biology teachers in the school district, with clusters of nodes indicating schools. Prior to 2013-14, no district-supported collaborative structures existed for Biology teachers; in 2013, a PD model with periodic collaborative release days and a curricular resource web page was established. Lines connecting nodes to the center indicate teachers' participation in the district-sponsored collaborations. Encouraging informal use of Carbon TIME resources in the network, which includes formal Carbon TIME participants, legitimizes peripheral participation with the learning progression system. The network structure provides teachers with access to Carbon TIME expertise, and the activities of the district network focus on deep interactions. Synchronizing Carbon TIME activities with district network activities supports sustained growth of the professional network over time.



Design-Based Implementation Research within the network



Initial Process Tool design
- Research staff wanted to scaffold student practices for conservation of matter and energy; scaffold teaching practices for formative assessment
- **Teacher thought tool unnecessary and redundant**; wanted scaffold for high-stakes state assessment prompts
- Students directly expressed appreciation for and desire to use process tool

Research staff and LEA leader in weekly meetings examine question of what features cause students, but not teacher, to value the process tool

Joint redesign of Process Tool (#1)
- Writing prompt aligned with state assessment criteria added
- Guiding questions refined

New format piloted with students; data analyzed by teacher, LEA leader, and research staff

Joint redesign of Process Tool (#2)
- Diagram added to support tracing of matter and energy
- Attention given to meaning of arrows as conceptual support
- Guiding questions refined

Teacher shared new version with network teachers, expressing value; teachers adopted use of process tool in their own classrooms

Network research plans

Aims
1. We will use both quantitative modeling and qualitative research methods to study teachers' patterns of participation in these networks and the effects of their participation on teachers' knowledge and practice and student learning.
2. We will also study the "boundary work" necessary as teachers, researchers, and administrators negotiate their differing priorities and interpretations.

Broad approach
- *Mixed method approach*
  - Rely on existing instruments: Assessments of students and teachers; interviews with teachers
  - Develop new instrument: Focus on network interactions, implementation, teachers' planning and instructional practices
- *Annual points of feedback for informing cohort/ network support iterations*
  - Initially work within a "cross-case" analysis frame (small N), move to quantitative/modeling approach

Sample survey constructs

Category	Sample constructs
Social network	• Closest professional colleagues • Help received from colleagues • Focus and frequency of collaborative interactions in network • Vision of NGSS
Planning and teaching practices	• Planning instruction • Use of educative elements of teaching materials • Engaging students in science & engineering practices • Making connections to crosscutting concepts
Implementation barriers and supports	• Perception of implementation supports and hindrances
Background & expertise	• Science PD in past 2 years • PD related to Carbon TIME • Experience • Changes to job conditions • Past exposure to Carbon TIME • Goals for participating in Carbon TIME

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