Moving Toward Collective Impact on Climate and Global Change Education

Tamara Shapiro Ledley – TERC, Cambridge, MA
Daniel Zalles – SRI International, California
Moving Toward Collective Impact on Climate and Global Change Education
Session Agenda

• 1:45-2:45 – Setting the Stage
  – What is Collective Impact and where are we with Collective Impact on Climate Literacy?
  – STORE Overview and how it might take advantage and contribute to Collective Impact
  – EarthLabs Overview and how it might take advantage and contribute to Collective Impact
  – Synergies between STORE and EarthLabs

• 2:45-3:45 Discussion with all session participants
  – What could an overarching backbone organization do to provide coordination and leveraging across member networks and partners to increase their reach and collective impact – review summary of shared doc http://tinyurl.com/mgwndtr
  – Can we begin to develop a common agenda for an overarching backbone network?
Collective Impact - Background

- Collective Impact
  - A way to frame discussions and organize diverse organizations around a shared vision
  - has proven successful in a variety of local to global-scale initiatives

- Conversations within the climate education community on how to more effectively organize and coordinate efforts began in 2012
  - Discussions at 6 formal meetings
  - the shared doc (http://tinyurl.com/mgwndtr) summarizes the current state of the discussions.

Collective Impact on the Local to Global Challenges Presented by Climate and Global Change Education, Literacy, Preparedness, Adaptation, and Mitigation

Tiny url for this page - http://tinyurl.com/mgwndtr

This is an evolving document that is integrating community input to define the elements of effective collective impact on climate and energy literacy. The venues at which input was obtained are listed at the bottom of this document. We are maintaining an email list of those who have participated in these discussions.

As of 5/16/14 input from all previous conversations has been integrated. The earlier document is at http://tinyurl.com/mzy8v4w.

Table of Contents
1. Participants........................................................................................................... 1
2. Background and Characteristics of Successful Collective Impact...................... 1
3. Network of Networks............................................................................................ 2
   A. General Comments and Considerations......................................................... 2
   B. What will the Overarching Backbone Organizational Structure Do.................. 4
      1. Provide Organization Across Member Networks and Partners..................... 4
      2. Support Individual Member Networks and Partners.................................... 6
4. Common Agenda and Shared System of Measures............................................ 8
5. Funding.................................................................................................................. 9
6. Vision - draft and comments................................................................................ 10
7. Moving Forward - the Continuing Discussion.................................................. 11
   Public Private Partnership..................................................................................... 12
8. Concerns................................................................................................................ 14
9. References ........................................................................................................... 14
Appendix A. Meeting at which discussions contributed to this document.............. 14
Pre-conditions of Collective Impact

1. Influential champion or small group of champions
2. Adequate financial resources
3. Sense of urgency for change
5 Elements of Collective Impact

Partners/contributors need to

1. Develop a **COMMON AGENDA**,  
2. Develop a **SHARED SYSTEM OF MEASURES** to track progress and success,  
3. Engage in **CONTINUOUS COMMUNICATION** that facilitates the building of the community of stakeholders,  
4. Identify **MUTUALLY REINFORCING ACTIVITIES** that address the *common agenda* and contribute to the measures of progress, and  
5. Have a **BACKBONE SUPPORT ORGANIZATION** with ample funding that can engage and coordinate all stakeholders in addressing and implementing of these elements.
Collective Impact on Climate Literacy
Summary of Evolving Discussion

• A Network of Networks
  – Overarching Backbone Support Organization
    • the network that fosters collaborations, sharing, leveraging and partnering between member networks
    • Aids member networks in identifying funders and securing funding
    • Supports member networks in defining their common agenda and shared measures
  – Member Networks
    • Large range in size – small individual project to national (or beyond) effort with multiple partners and audiences
    • Would benefit from coordination and leveraging with other aligned or complementary efforts
Overarching Backbone Support Network

- Have an overarching common agenda that can scale down to the concrete goals of the Member Networks common agenda
- Enabling excellent communication with and between Member Networks
Activities of an Overarching Backbone Support Organization

- Enable overarching issues to be effectively addressed in different networks/communities
- Facilitate communication and leveraging of services, information, knowledge, experiences, resources and materials
- Development of partnerships from external groups/communities with needed expertise
- Unified messaging – dissemination, marketing, outreach
- Support Member Networks
- Shared Measures – Evaluation of progress across networks
Overarching Backbone Organization: Support for Member Networks

- Provide support Member Networks in the development of their specific common agenda and shared measures
- Help Member Network reach larger and more diverse audiences
- Work with Member Networks to seek and secure funding
- Provide facilitators for Member Networks for these activities when needed
Collective Impact on Climate Literacy
Vision and Common Agenda

• Drafted December 2013
Enabling society and the future generations to understand, address, and solve pressing local to global challenges presented by climate and global change.

• Extensive comments have been received during the subsequent meetings – listed in share document
Collective Impact & the STORE Project

Daniel Zalles, PI
DRK12 PI Meeting
Aug 5, 2014
SRI International
Welcome to STORE

STORE is a three-year project using innovative Geospatial Information Technology-based learning in high school environmental science studies with a focus on the meteorological and ecological impacts of climate change. Through a co-design and design-based research approach with teacher partners, the project has developed (1) GIS data files that promote learning of the analytical skills necessary to scientifically investigate the potential consequences of projected climate change on local ecosystems and (2) a place-based curriculum module exemplar consisting of six lessons that demonstrate how the tool can be used in classrooms for student study of the focal science concepts. To increase the likelihood of successful classroom implementation and impact on student learning, we have devised a teacher professional development process that provides the conditions for the teachers to make good adaptability decisions for successful follow-through. We are examining the use of the tool and curriculum during two years of classroom implementation.

NOTE: Until September 2013, STORE will still be in development and field testing phases. Hence, materials on this website may be revised or updated without notice until then.
STORE Development Goal

• Getting teachers to use in their science classes rich data sets about regional "study areas“ that illustrate key principles in Earth science, environmental science, and biology
  – Orographic rainfall, dew point, temperature lapse rate, relative humidity, air pressure
  – Climate as an outcome of repeating weather patterns
  – How different biomes form different predominating vegetation
  – How scientists use models to project climate changes and effects on the ecosystems in the study area
  – To maximize teacher interest across science domains and courses, usage of the data, not the lessons
STORE Research Goal

• Study what it takes to maintain teacher engagement and what professional development strategies are feasible relative to teachers’ constraints

• Gather information about how teachers build their technological, pedagogical, and content knowledge with the innovation
• Look at relationships between teacher plans, implementation practices, and student outcomes using a common assessment instrument

• Create an archive of freely downloadable geo-data, core lessons and teacher adapted lessons

• Make the data usable in free non-cloud-based software programs Google Earth and ARC GIS Explorer Desktop
STORE technology (cont.)
STORE Project-developed lessons

- **Basic Lesson 1**: Students learn key meteorological principles that are used throughout the STORE curriculum.

- **Basic Lesson 2**: Students study temperature and precipitation changes in the California study area, which encapsulates a series of weather stations at different elevations.

- **Basic Lesson 3**: Students compare mean annual precipitation and for weather stations along the Bay Area/Sierra profile against the elevation of each station. They also compare ground surface temperature lapse rates with atmospheric lapse rates to see how they differ and why.

- **Basic Lesson 4**: Students explore how local climate affects vegetation in the study areas by overlaying vegetation zones (grouped by vegetation communities) on maps of precipitation and temperature, and digitally analyze these data.

- **Advanced Lesson 1**: Students use the GIS software to compare projected year 2050 precipitation from the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) to current precipitation, analyze the relative amount of change in precipitation within the California study area, and map the projected 2050 spatial distributions of vegetation communities in the Sierra Nevada Mountains portion of the California study area in 2050.

- **Advanced Lesson 2**: Students use the GIS software to compare projected year 2050 air temperatures from the National Center for Atmospheric Research (NCAR) Community Climate System Model (CCSM) to current temperatures, then map the projected 2050 spatial distributions of vegetation communities in the Sierra Nevada Mountains portion of the California study area. Students use the GIS software to compare projected year 2050 temperatures from the CCSM to current temperatures, then project the future spatial distribution of vegetation in the Sierra Nevada Mountains portion of the California study area.
<table>
<thead>
<tr>
<th>Teacher</th>
<th>Course</th>
<th>Student Demographics</th>
<th>Grade level</th>
<th>Collaborator</th>
<th>Description</th>
<th>Links</th>
</tr>
</thead>
</table>
| Alice Albertson  | AP Environmental Science      | At the school:  
- Total Students: 1,764  
- Classroom Teachers (FTE): 95.05  
- Student/Teacher Ratio: 18.56  
- Title 1 School  
- American Indian/Alaskan: 7  
- Asian/Pacific Islander: 128  
- Black: 66  
- Hispanic: 996  
- White: 536  
- Two or more races: 31  
In the district:  
- ELL students in the district: 1,818  
- Students with IEPs in the district: 1,035 | 11, 12      |              | (1) Content Representations for the various SRI project-developed STORE lessons that this teacher used. (2) Some extra worksheets about climate. | 01 AA STORE Content Representation for Geospatial Technology Class  
02 AA STORE Content Representation for Environmental Science Classes  
03 AA Biome template assignment (extra)  
04 AA Climatogram assignment (extra)    |
<table>
<thead>
<tr>
<th>Teacher</th>
<th>Subject</th>
<th>School Type</th>
<th>Ethnicity</th>
<th>Lesson Description</th>
<th>Tools Used</th>
</tr>
</thead>
</table>
| Jack Thomas      | Geospatial Technology | A rural community college                      | American Indian/Alaskan: 1.65%  
Asian: 1.54%  
Pacfic Islander: .76%  
Filipino: .59%  
Black: 5.86%  
Hispanic: 14.20%  
White: 61.10% | GIS-intensive version of STORE Basic Lesson 2, enhanced with attention to plate tectonics. | 01 JT STORE Content Representation  
02 JT GIS-intensive STORE Basic Lesson 2 for ARC GIS Explorer Desktop |
| Jerry Randolph   | Science and Math  | Private school in rural community:              | Asian: 5  
Hispanic: 6  
White: 162 | (1) Field work activities for observing and collecting data about the forest environment around the school.  
(2) Adaptation for middle school of the math-centered and conceptually dense STORE Basic Lesson 1; | 01 JR Adaptation of SRI pre-developed STORE Basic Lesson 1  
02 JR Content Representation for STORE GE Lab Activities  
03 JR STORE GE Lab More Structured |
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

Self-selected design partner teachers recruited
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

Self-selected design partner teachers recruited

Modified data layers, new tool, adaptable versions of core lessons
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

Self-selected design partner teachers recruited

Modified data layers, new tool, adaptable versions of core lessons

Larger set of self-selected teachers recruited by word of mouth
Design Research – Exploratory STORE Project

- R&D Team develops innovation: geo-data layers and core lessons
- Self-selected design partner teachers recruited
- Modified data layers, new tool, adaptable versions of core lessons
- Larger set of self-selected teachers recruited by word of mouth
- Iterative PD implementation, assessment
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

Self-selected design partner teachers recruited

Modified data layers, new tool, adaptable versions of core lessons

Larger set of self-selected teachers recruited by word of mouth

Iterative PD implementation, assessment

Word of mouth dissemination
Alliances and collaborations with other stakeholders in the greater educational system to strengthen STORE’s impacts

- Employ principles of design based implementation research to build the most systemic support and the most systemic impact on student learning
- District administrators
- Local university teacher training programs
Challenges for future sustainability of the innovation

- Updating the data - new climatologies, new predominating land cover surveys, revised climate change projections
- Keeping up with changing software features imposed by the vendors (ESRI, Google)
- Mixed teacher abilities to check for student understanding and respond to student questions
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

Self-selected design partner teachers recruited

Modified data layers, new tool, adaptable versions of core lessons

Larger set of self-selected teachers recruited by word of mouth

Iterative PD implementation, assessment

Word of mouth dissemination

Design-based implementation research

Systemic school/district input, endorsement & support
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

- Self-selected design partner teachers recruited
- Modified data layers, new tool, adaptable versions of core lessons
- Larger set of self-selected teachers recruited by word of mouth

Iterative PD implementation, assessment

Word of mouth dissemination

Design-based implementation research

Systemic school/district input, endorsement & support

- Early adopters → Early majority → Late Majority → Laggards

Word of mouth dissemination
Design Research – Exploratory STORE Project

R&D Team develops innovation: geo-data layers and core lessons

Self-selected design partner teachers recruited

Modified data layers, new tool, adaptable versions of core lessons

Larger set of self-selected teachers recruited by word of mouth

Iterative PD implementation, assessment

Word of mouth dissemination

Design-based implementation research

Systemic school/district input, endorsement & support

Early adopters → Early majority → Late Majority → Laggards

Improved teacher performance

High student learning outcomes
Wide
innovation
success
Systemic adoption & support of innovation → Wide innovation success
Systemic adoption & support of innovation

Supportive systemic processes and structures (technology infrastructure, professional development, formative assessment, incentives)

Wide innovation success
Systemic adoption & support of innovation

Supportive systemic processes and structures (technology infrastructure, professional development, formative assessment, incentives)

Organizations making it possible for the practitioner systems to find the innovations and do what is needed to make them worth implementing

Wide innovation success
What it would take to sustain STORE over the long term to remain a continually viable and useful resource

• Brokers helping practitioners and the STORE team find each other and explore common interests

• Solutions-oriented professional development that builds administrative support and holds open the possibility of different types of solutions relative to cost.

• Selectable alternatives:
  – Parallel data sets for study areas in the regions of the newly participating practitioners
  – Alignments to local standards
  – Staff development options (release days, summer days, weekends)
  – Whether to use a mentorship approach for scaling up
  – Whether to also train administrators in the innovation
EarthLabs
for Educators and Policy Makers

http://serc.carleton.edu/earthlabs

- A web-based Earth science resource comprised of lab based curriculum modules – laboratory component of high school capstone course

- Each module of 5-9 labs highlights an Earth system approach to understanding Earth Science and includes a mixture of
  - text
  - hands-on lab investigations
  - videos
  - data
  - web-based interactive visualizations
• Teachers Guide
  http://serc.carleton.edu/earthlabs

• Student Portal –
  http://serc.carleton.edu/eslabs
## EarthLabs – Climate Project Components

<table>
<thead>
<tr>
<th>Curriculum Development</th>
<th>Teacher Professional Development (PD)</th>
<th>Research on Student Understanding of Change Over Time and Space</th>
</tr>
</thead>
</table>
| 4 EarthLabs modules developed collaboratively by 4 curriculum developers with input from practicing teachers  
  • Climate & Cryosphere  
  • Climate & Biosphere  
  • Climate and Carbon Cycle  
  • Climate Detectives  
  Feedback from Teacher Leaders, PD Evaluations, and research on student learning used to improve modules | Teacher Leaders  
  1. Review modules  
  2. Pilot Modules  
  3. Prepare to deliver PD to other teachers  
  4. Weeklong summer workshops in Texas and Mississippi led by 9 Teacher Leaders  
  Workshop Participants  
  1. 20-25 in each workshop  
  2. 2012 - Two workshops  
  • 1 in TX & 1 in MS  
  3. 2013  
  • 2 in TX & 1 in MS | Teacher Leaders & Workshop Participants implement modules in classroom for research  
  Climate Concept Inventory Development  
  • Student pre- and post-tests used to determine the extent to which modules support student understanding of change over time & space  
  Eye-Tracking Studies  
  • External Users test usability of the EarthLabs curriculum |
Earth Labs: Modules containing lessons and highly structured computer and wet labs around key concepts

Large regional “master data sets” and future climate projections that reify key science concepts

Information about how the data layers such as “predominating vegetation” are derived and displayed (data literacy)

Information about how the model-based projections are derived

GIS and Excel Tool-manipulation opportunities

Accompanying adaptable lessons, plus teacher-authored adaptations

Expanded scope of offerings on module topics, such as climate & the biosphere
EarthLabs

- ~15 Teacher Leaders trained in TX and MS
- ~100 teachers trained in use of EarthLabs materials
- Model of professional development that can extend reach of effort
- Input on how to support student understanding of change over time and space.

STORE

- 12 teachers reached in CA and NY
- Extend reach of the materials to more teachers
  - Teacher PD model
  - Extend to other states
- Enhance website use (Eye Tracking analyses)
Moving Toward Collective Impact on Climate and Global Change Education

Discussion

• What could an overarching backbone organization do to
  – to increase your individual project’s effectiveness and reach (e.g., finding new audiences, incorporating others’ innovations in your efforts)
  – help your project benefit others (e.g., providing your audiences and innovations to others)

• Link to shared document (in Google Docs)
  http://tinyurl.com/mgwndtr