STEM Learning and Research (STELAR) Center @ Education Development Center

Smart and Connected Communities: An ITEST Perspective
Thursday January 21, 2016
Agenda

• Introduction
• Smart and Connected Communities: A description
• Two Projects: Looking Toward Smart and Connected Communities
  – *Curriculum + Community Enterprise for Restoration Science in New York Harbor*
  – *STUDIO: Build Our World: A University-Community Collaboration to Support Low-Income and Immigrant Youth in STEM*
• Smart and Connected Communities across NSF’s EHR
Who We Are

• STEM Learning & Research Center (STELAR)
• Education Development Center
• Supporting the program and its grantees since 2003
• Available to assist considering submitting an ITEST proposal
• http://stelar.edc.org
What We Do

• Facilitate projects’ success through **technical support** with a focus on synthesis of findings

• Inform and influence the field of STEM stakeholders by **disseminating** project findings nationally

• Deepen the impact and reach of the ITEST program by **broadening participation** in the ITEST portfolio
Some of Our Activities

- **Webinars**: Effective Dissemination, Designing Research for ITEST Projects, Mentoring Models
- **Monthly Newsletter**: Information to stay updated on all things STEM and ITEST
- **Project Liaisons**: A STELAR staffer who works directly with each project to provide resources and make connections
- **Regional and Thematic Meetings**: A way for current projects to network with each other
- **Management Information System (MIS)**: Annual collection of project information about what projects do, who they work with, what they have achieved
Find Resources on STELAR Website
Get Ideas for Designing ITEST Proposals

Are you considering submitting a proposal to ITEST? You have come to the right place. The resources under each heading below provide valuable information to help you develop a competitive proposal:

- The ITEST solicitation webinars provide an overview of the ITEST program as well as details on what to include and what not to include in your proposal.
- STELAR themed webinars demonstrate how previous ITEST projects have tackled topics that are of interest to the ITEST program.
- Data and Info Briefs are publications that summarize the activities of the ITEST projects in a given year. Knowing what has been done previously may help you develop an innovative proposal.
- Other publications provide background information on topics that are of interest to the ITEST program.

In addition, we suggest you also peruse the other areas of the STELAR website to learn more about your specific area of interest. We encourage you to browse the project profiles to see what projects have already been funded, read ITEST Program Findings to discover what the previously funded ITEST projects have learned from their research and implementation efforts, and search within resources to find instruments and curricular materials used and developed by ITEST projects.

**GET TO KNOW ITEST**

**PREPARE YOUR PROPOSAL FOR SUBMISSION**

**DEVELOP A ROBUST RESEARCH DESIGN**

**CREATE AN EFFECTIVE EVALUATION STRATEGY**

**CONNECT WITH PARTNERS**

**REACH URSERVED POPULATIONS**

**DEVELOP THE WORKFORCE OF THE FUTURE**
Find Project Profiles

Search Results

Projects

1 - 8 of 19

Search for Projects

Multiple criteria within a field is an OR condition. Multiple fields are AND conditions.

TEXT SEARCH

+ DISCIPLINE(S)
+ PROJECT PARTICIPANT(S)
+ PROJECT GRADE SPAN(S)
+ PROJECT SETTING(S)
+ STATES WHERE WORK OCCURS
+ PROJECT STATUS

Apply Filters  Clear Filters

Advancing Geospatial Thinking and Technologies in Grades 9-12: Citizen Mapping, Community Engagement, and Career Preparation in STEM

Given recent advancements in geospatial technologies and the expanding geospatial technology industry, this project is timely in its focus on spatial thinking and strengthening geospatial technology skills among high school students.

READ MORE »

Back to the Earth
2012 National Survey of Science and Mathematics Education: Science Teacher Questionnaire

Instruments

2012 National Survey of Science and Mathematics Education: Science Teacher Questionnaire solicits information regarding K-12 science teachers' opinions, their preparation, and their teacher practice. The questionnaire was developed and...
Connect with others via the People Connector

http://stelar.edc.org/opportunities/people-connector-directory

People Connector Form

People Connector Directory
And lots more!
STELAR is on Social Media – Stay in Touch!

Contact us: stelar@edc.org

“Like” us: https://www.facebook.com/stelarctr

Follow us: https://twitter.com/STELAR_CTR

Watch us: https://www.youtube.com/user/stelarcenter

Find resources: http://stelar.edc.org/
NSF Next Generation STEM Learning for All

• Showcased NSF-funded research and development and informed policy makers about the potential to transform STEM learning and education

• Engaged a broad community of stakeholders in envisioning the future of STEM learning and in strategizing how to best achieve collective impact

• Facilitated networking across stakeholder groups to leverage skills and strengthen connections, collaboration, and coordination toward national goals for STEM education

http://nsfstemforum.edc.org
Today’s presenters

Anthony Kelly: Senior Advisor in the Education and Human Resources Directorate at the National Science Foundation

Lauren Birney: Assistant Professor, Pace University School of Education and Co-Director of the STEM Collaboratory NYC™

Leslie Herrenkohl: Co-Director of the 3DL Partnership and Professor in the College of Education at the University of Washington

John Cherniavski: Senior Advisor in Division of Research on Learning in Formal and Informal Environments at the National Science Foundation
Evaluation link

Please click here to provide feedback on this webinar:
https://edc.co1.qualtrics.com/SE/?SID=SV_5irt07skpMZDcCF
Smart and Connected Communities:
STEM, STEM Education, STEM Education Research

Anthony E. Kelly
Senior Advisor
Directorate for Education and Human Resources
National Science Foundation
akelly@nsf.gov
Who is eligible for funding under the S&CC Dear Colleague Letter?

1. Principal Investigators (PIs) with an existing award that can be supplemented

2. PIs who work with a program officer to submit an EAGER proposal with a March 1, 2016 deadline


**Read the S&CC Dear Colleague Letter!**

**Talk to a program officer!** Program officers are listed on the Dear Colleague Letter.

Note: Taylor Martin is no longer with the NSF.
Please substitute: John Cherniavsky, jchernia@nsf.gov
What is a “smart and connected community” problem?

- A S&CC problem is one that motivates some community (e.g., tribe, region, town, rural group, city, megacity) to work with researchers and other professionals to design, deploy and evaluate an intervention that has potential to ameliorate the identified problem.

- An intervention is “smart and connected” when it takes advantage of emerging nested systems of cyber physical sensors, Internet of Things, wearable technologies, mobile systems, etc.

- An intervention is “smart and connected” when it involves the creative engagement of one or more communities and their distributed human and social capital (e.g., tribal representatives, city planners, formal and informal education participants, including teachers, students, citizen scientists, or the maker movement).

- A compelling case should be made that the intervention is likely to lead to outcomes such as powerful and resilient models and solutions, efficiencies in resources, advances in science and engineering knowledge and practices, and STEM education practices and research.
Proposals are encouraged on smart and connected research methodology...

• All communities are distinctive: Interventions may need to respond to unique physical, social, cultural, political, resource, and economic contexts.

• Activity is malleable and collaborative: Interventions are likely to be field based, iterative, and involve human centric design-based research methods [see Bannan (2015)]

• The law of unintended consequences: Interventions are likely to be deployed in a complex system with unexpected interdependencies that may need to be documented or accounted for (e.g., a water runoff intervention may add to pollution; improved traffic flow for airport staff in one city may positively impact congestion in the airport traffic of a distant city)

• Communities do not exist in a vacuum: In some cases, exogenous challenges may require attention (e.g., changes in political support, privacy concerns, cyber attacks, natural disasters).
Research is required on smart and connected, project capacity building and communication...

**Metrics:**

- The design of qualitative and quantitative indicators that operationalize the subjective nature of the outcomes: “personal quality of life, community and environmental health, social well-being, educational achievement, or overall economic growth and stability” -- from the Dear Colleague Letter.
- Methods of hypothesis generation and testing using a range of research and evaluation approaches to assess outcomes from S&CC projects.

**Data management, sharing, and analysis:**

- How to document, disseminate, and scale successful interventions, and to communicate lessons learned.
- Methods to link personnel across a variety of S&CC projects and to share data and methods so as to synergize resources and enrich the lessons learned about science and engineering content and practices, and about STEM education.

**Growth:**

- How to build community and capacity in the scientific and educational workforce in order to design, deploy and communicate effective S&CC models and interventions.
Summary

Consistent with the goals of broadening participation, advancing scientific knowledge and educational practices, and promoting scientific workforce development, we welcome great ideas on how:

• the wide range of resources of formal and informal education
• research on teaching and learning
• knowledge of curricular design and development
• research on graduate and postdoctoral education
• effective cyberlearning strategies
• workforce development strategies
• research and evaluation innovations
• indicator and assessment innovations
• and related resources . . .

may maximize the many opportunities provided by smart and connected technological and social ecosystems to enable more livable, workable, sustainable, and connected communities.
NSF-EHR S&CC Dear Colleague
Letter Contact

John Cherniavsky
Program Officer
jchernia@nsf.gov
(703) 292-5136
Curriculum + Community Enterprise for Restoration Science in New York Harbor
Project Partners

Pace University Teacher Training; Pedagogical Inputs
New York Harbor Foundation Oyster restoration & pedagogical model
Columbia University Field science research protocol & curriculum development
New York Academy of Sciences After-school STEM Mentoring & Curriculum Development
The Good Shepherd Service After-school STEM Mentoring and programming
University of Maryland Center for Environ Science Tech development and field ecology
The River Project Informal Education and field training
The New York Aquarium Informal education, Field Trips, Museum Exhibition
NYC Department of Education Access to teachers, students and schools
Gaylen Moore Incorporated External Evaluation
SmartStart Corporation Evaluation and research.
NSF EHR and ITEST Funding ($5M/3 years). DRL 1440869
The CCERS model is a multifaceted approach used to integrate restoration science into the middle school STEM curriculum.
STEM Curriculum + Community Enterprise for Restoration Science
(STEM CCE-RS) Project

Locations

Pillar 1
Teacher Training Curriculum

Teacher Training
Pace University & Harbor Foundation
Sites: 1 Pace classroom

Pillar 2
STEM CCE Student Learning Curriculum

Student Learning
NYC Public Schools & Columbia University
Sites: 16 classrooms per year

Pillar 3
Digital Information and Communication
University of Maryland Center for Environmental Science

Digital Information and Communication

Pillar 4
Afterschool Mentoring
Good Shepherd Services & New York Academy of Sciences
Sites: 7 GSS

Afterschool Mentoring

Pillar 5
Marine Research
The River Project & New York Aquarium
Sites: 2 Marine Research Waterfront Sites: 8 or more

Marine Research

Application and Support

Pillar

Pillar 1
Teacher Training Curriculum

Pillar 2
STEM CCE Student Learning Curriculum

Pillar 3
Digital Information and Communication

Pillar 4
Afterschool Mentoring & Summer Mentoring

Pillar 5
Community Restoration - Based Exhibits
• Create Teacher Training Fellowship for professional development.
• Create digital repository of CCERS project materials and lesson plans.
• Create mobile application for citizen scientists to monitor environment.
• Engage public in inquiry on oysters, & biodiversity in local environment.
• Increase STEM-C knowledge by demonstrating real world applications.

Short-term process

Teacher Training
Train teachers to more effectively teach STEM-C concepts using restoration science by implementing PBL into their classrooms

Student Curriculum
Provide engaging STEM-C lessons focusing on harbor restoration and research activities for students within their daily classroom lessons

Digital Platform
Create a digital platform where teachers can contribute and collaborate on lessons and data centered on restoration science

Afterschool Summer Mentoring
Develop curriculum tailored to low-resource settings to engage students in STEM-C concepts by focusing on invertebrate zoology

Community Exhibits
Develop interactive exhibits for students and others to learn about oysters’ role in the local ecosystem and biodiversity in the harbor

Long-term vision of model

• Develop curriculum using restoration science to teach core STEM-C concepts to middle school students across various educational settings.
• Create replicable model transportable into other locations and environments to increase student learning and restoration efforts.
Restoration Goal: Bring Oysters back to New York Harbor

Why oysters?

Keystone species

Historically abundant

Critical to ecological health and habitat

Accessible environment for students.

Goal of Project: expand to other keystone species in other environments.
**Monthly Teaching Fellowship Workshops**

- Teacher training at Pace University’s School of Education.
- 20 to 25 teachers in each cohort/ 44 Teachers 24 Schools
- Responsible for implementing the curriculum. → Drill down to units and lesson plans.
- Several weekend days devoted to learning and practicing field protocols.

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<td>Oyster Reef Ecology</td>
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<td>Big Picture: Social Ecological Change</td>
<td>Kate Orff</td>
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**3 Hours: 5:30 – 8:30**

- Dinner
- Invited science speaker
- Hands-on activity
- Housekeeping
- Evaluation materials
Each teaching Fellow is responsible to take their class on at least one Field trip to our partnering aquariums.

The River Project
- Pier 40 on the Hudson River
- Touch tanks with HR critters
- Flow-through estuary water
- Experienced staff
- Informal, adaptable work space

New York Aquarium Exhibit – Planned for Spring 2017
(Currently rebuilding from storm (Sandy) damage)

Introduction to NY Harbor Ecology/Geography/History (whole class)

Stations: (Students in 4 groups and rotate through each of these stations)
- Lab Tour
  - Hudson River biodiversity! Touch tank, crabs ….
  - Habitat and habits, predator and prey relationships
  - Closer look at Hudson River ecosystem and ecology
- Water Quality Monitoring
  - Turbidity
  - Salinity
  - Temperature
  - Data collection and comparison – research methods
  - How it relates to oysters
- Oyster Reef
  - NYC oyster history
  - Other animals in reef
  - Handling live oysters
  - Ecosystem services, other sessile organisms, predators
- Oyster anatomy
  - Pre-shucked oysters
    - 3 per student,
    - Go through anatomy with students as a group
    - Students explore the oysters in pairs
- Wrap-up
  - Conclusion discussion about trip
  - Washing hands / post-trip evaluation survey
After-School STEM Mentoring
New York Academy of Sciences
and the Good Shepherd Services

STEM programming – meeting enhanced NYC standards for after school programs.

Wrap-around programming: in and out of school. Serving working class and poor families.

8 Schools

Year 1: developed 10 units, with full sets of supporting materials.

Graduate student after-school teaching assistants.

Building on existing NYAS programming, aiming for permanent expansion of NYAS/GSS programming.

STEM Lessons

- New York Harbor History
- Oyster Habitat and Runoff
- How do we something’s alive?
- Marine Invertebrates
- Oyster Anatomy
- Oyster Filtration
- Oyster Life Cycle
- Oyster Habitat and Diversity
- What is an Estuarine Ecosystem?
- Oyster Habitat and Water Quality
- Capstone: Oyster Gardening
- Capstone: PSA Project
New York Harbor Fieldwork: 33 Restoration Sites

On shorelines in all 5 New York City boroughs:

- East River
- Harlem River
- Hudson River
- Bronx River
- Arthur Kill
- Kill Van Kull
- Mill Basin
- Coney Island Creek
- Flushing Bay
- Great Kills Harbor
- Coney Island Creek
- Jamaica Bay
- Navy Yard Basin
- Paerdegat Basin
- Upper NY Bay

Students measure:
- Oyster growth
- Sessile invertebrates
- Mobile critters
- Settlement plates
- Temperature
- Salinity
- Nutrient levels
- Turbidity
- Current speed
- Winds

Working in 5 teams:
I: Site Conditions
II: Oysters
III: Mobile Trap
IV: Settlement Tiles
V: Water Quality
Smartphone app for data input
• Species key with photos
• Input assists with basic quality checks

Central repository for
• Lesson plans
• Protocols and field guides
• Shared data
• Classroom dashboard for access and exchange
# Broader Impact NSF CCERS

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| **Pillar 1**  
Teacher Training | Pace University  
NYHF  
New York Department of Education  
Columbia University | The STEM Collaboratory NYC™  
Citizen Scientists  
[http://billionoysterproject.org/training/](http://billionoysterproject.org/training/)  
| **Pillar 2**  
Field Science Research | Columbia University  
NYHF | Research Programs and Institutions for Teachers | [http://www.ideo.columbia.edu/SSFRP](http://www.ideo.columbia.edu/SSFRP) |
| **Pillar 3**  
Digital Platform | University of Maryland Center for Environmental Sciences | World Harbor Foundation; International Growth and Partners  
| **Pillar 4**  
Afterschool STEM Mentoring | The New York Academy of Sciences  
Good Shepherd Services | Advanced STEM Summer Programs for Students  
| **Pillar 5**  
Museum Exhibitions and Field Trips | The New York Aquarium  
The River Project | Summer Internships and Externships for Teachers and Students | [http://nyaquarium.com/activities](http://nyaquarium.com/activities)  
I. **Challenge**: How do you involve middle school students to become engaged with STEM Education as Citizen Scientists and create opportunities for sustainable community involvement?

II. **Solution: Replicable Model** “The Living Ecosystem - New York City Harbor”
   Environmental Restoration through Citizen Science and Inquiry Based Learning with Three Distinct Learning Strands

III. **Evidence of Research**: Dissemination of Findings
   - Webinars, Podcasts, Presentations, Publications
   - Public Interest Papers, White paper
I. SCC Project Objective

This project focuses upon the expansion of the existing "Curriculum and Community Enterprise for the Restoration of New York Harbor in New York City Public Schools" DRL 1440869. In particular, we aim to incorporate components of the project that leverage the assets set forth by Smart and Connected Communities and their ability to incorporate environmental restoration through citizen science, community support, local collaborations and global partnerships. It is the unique connection and inter-dependency of these particular facets that will allow New York Harbor as the central hub of e-commerce to expand, grow, cultivate and ultimately flourish and thrive.

II. SCC Program Goals

1. Establish a Comprehensive Model that depicts an interdependent, innovative system composed of stakeholders, constituents and collaborators.
2. Identify Industry Partners for collaborations and partnerships whom will offer; guest speakers, internships, externships, mentorships and project collaborations.
3. Identify Corporate Partners for continued funding, partnership collaborations and support.

III. Educational Vertical Planning Pods

Strand Leaders, Corporate Partner, Faculty Member, Graduate Student, Undergraduate Student, HS/MS Teacher, High School Student, Middle School Student

I. Summer Colloquia and Think Tank – Pace University (3 week sessions)
II. Internships and Externships with Corporate Sponsors
III. White Paper and Project Dissemination National and International
Grazie! Lauren Birney lbirney@pace.edu Pace University, New York City
NSF DRL 1440869/PI Birney
STUDIO: Build Our World
A University-Community Collaboration to Support Low-Income and Immigrant Youth in STEM

Leslie Rupert Herrenkohl, Ph.D.
University of Washington & Neighborhood House
(NSF DRL # 1310817/1311253)

STELAR WEBINAR on Smart & Connected Communities
January 21, 2016
What is STUDIO?

A program that supports middle and high school youth to:

Develop interest, motivation, & identification with STEM

Learn about STEM higher education & STEM careers
Principles

1. STEM is a human activity grounded in culture and place.

2. Equity in STEM requires providing access to opportunities and recognizing the contributions youth and their communities make to STEM.

3. Locating STEM programming inside a wrap-around service organization provides for multiple needs of youth and their families.

4. Out-of-school STEM learning opportunities in middle and high school are critical to support long-term STEM engagement.
High Point Neighborhood House (NH)

NH has been working in the low-income community of High Point since 1966 and opened its High Point Center in 2009. The High Point neighborhood is home to:

- 2,127 individuals (580 families)
- 54% of its residents under 18
- 42% of the children/youth served are immigrants and refugees from East Africa (Somali, Ethiopian and Eritrean)
- 13% are immigrants and refugees from Southeast Asia (Vietnamese and Cambodian)
- 3% are immigrants and refugees from Central and South America
2014-2015 Neighborhood House Youth
2015-2016 UW Mentors

UW STEM MAJORS:

Computer Engineering
Applied Physics
Chemistry
Mathematics

Molecular, Cellular, & Developmental Biology
Human Centered Design & Engineering,
Aerospace Engineering
Microbiology
STUDIO Activities

Year 1 (2014-2015)
- Making & Tinkering Hands-on Activities
- Digital Tinkering, Coding, and Gaming
- Making & Tinkering in Health

Year 2 (2015-2016)
Using curriculum developed/adapted in 2014-2015 with a focus on increasing NH youth agency through interest-driven, sustained project work that utilizes NH staff and UW mentor expertise. Integrate discussions of college and career throughout activities.
Place, context, & systems as a key to smart & connected communities

Making & Tinkering in Health
STUDIO: Some conclusions & considerations

-Makes access to programming for low income and immigrant youth “at their back door”

-Provides broad support services for families and youth

-Increases opportunities to meet families and receive input from and recognize STEM assets in the community

-Shared priorities yet complementary expertise mean our organizations could not do this work alone

-Time intensive work that requires significant relationship building & trust

-Work culture expectations and differences can create challenges

-Communication and coordination require careful consideration to establish effective practices

-Onboarding newcomers (youth, mentors) while continuing to support existing participants can be a challenge

-Staff turnover can create stress and uncertainty
THANK YOU

National Science Foundation & Dr. Celeste Pea
STELAR
The Exploratorium Tinkering Studio

For more information contact:
leslieh@uw.edu
EHR and S&CC

John Cherniavsky
Senior Advisor, Division of Research on Learning
Some Useful Links for S&CC

- CIRCL Ideas Lab: [http://circlcenter.org/events/innovation-lab/](http://circlcenter.org/events/innovation-lab/)
- EnvisionAmerica: [http://envisionamerica.org/proposed-agenda/](http://envisionamerica.org/proposed-agenda/)
- NSF Seattle Meeting: [http://cps-vo.org/group/NSF-SmartCities2016/program-agenda](http://cps-vo.org/group/NSF-SmartCities2016/program-agenda)
- European Open Living Labs: [http://openlivinglabs.eu/node/923](http://openlivinglabs.eu/node/923)
Some EHR Connections to Smart and Connected Communities

- Workforce Development – S&CC Multidisciplinary Communities of Interest to develop a workforce capable of working on S&CC problems

- Complex System Development and Representations for S&CC – EHR researchers would be part of such a complex system where the collective intelligence of the Community is studied as S&CC problems are addressed

- Instilling civic and societal responsibility in young people – learning as they actively engage in addressing S&CC problems

- Use of learning technologies in addressing S&CC problems – examples include augmented reality, data mining, multi-media visualizations, and other mechanisms to enhance learning of complex systems
Example 1: Digital Youth Network and Chicago City of Learning

The Digital Youth Network is, at its core, a design-based research project. The research team works with DYN mentors, students, families, and other practitioners to better understand the impact of DYN initiatives and learning environments on youth, educators, organizations, and communities, identifying critical practices and informing iterations of the DYN model. Current research questions include: How do we understand and represent learning and participation in informal (including online) environments and over time?

Broadening Participation in Computing through a Community Approach to Learning

Developing frameworks, tools, and social practices to support effective instructor use of online social learning networks in blended learning models

Exploring learning, participation, and mentorship in the Chicago Summer of Learning (CSOL) 2013

Identifying educator roles that support students in online environments

Cultivating Digital Citizenship and Creative Production at Renaissance Academy

https://chicagocityoflearning.org/ and http://www.digitalyouthnetwork.org/
Example 2: Schools as part of S&CC team

Hypothetical Example

High School students in communities in the Marcellus Pennsylvania are part of a team of scientists, community leaders, and Marcellus Shale Coalition studying the effects of fracking in the Appalachian Basin. The students act both as citizen scientists collecting water samples and air samples from near their homes and as students in science courses (environmental or earth sciences) in their schools. Through the use of data mining, visualization tools and simulation and modeling tools they have full access to all the data collected to analyze the economic impact of fracking on Appalachian communities (this includes job data, data on transportation and other infrastructure, health data, environmental impact data, etc.). Learning scientists associated with the S&CC project using design based implementation research methods study the effectiveness of student learning through their involvement in the S&CC project.
Example 3: Workforce Development Possibilities

National Science Foundation Research Traineeships

https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505015

New Programs at Universities

Example NYU Center for Urban Science + Progress (CUSP)

Urban informatics uses data to better understand how cities work. This understanding can remedy a wide range of issues affecting the everyday lives of citizens and the long-term health and efficiency of cities — from morning commutes to emergency preparedness to air quality. CUSP aims to be the world’s leading authority on the emerging field of urban informatics, with New York City as its laboratory and classroom. The urban issues CUSP takes on will be New York’s. The solutions it creates will make the city more productive, livable, equitable, and resilient.