

BUILDING COMMUNITIES OF TRANSFORMATION: SENCER AND SENCER-ISE

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INTRODUCTION

More than ever, our nation faces critical public policy issues related to the environment, health, applications of technology, and other key societal challenges. At the same time, informal science organizations increasingly seek to demonstrate their relevance as community learning resources and important sites of public engagement with civic issues. For these reasons, they can benefit from learning about the National Center for Science and Civic Engagement and its SENCER (Science Education for New Civic Engagement and Responsibilities) initiative.

The mission of the National Center is *“to empower citizens as responsible, lifelong learners who can apply the knowledge, values, and methods of science to the complex civic challenges facing our democracy.”* As their website (<http://ncsce.net>) notes, *“By putting content into context, what is inaccessible becomes accessible, what is uninteresting becomes interesting, and what is not meaningful becomes meaningful. We empower learners by showing them that their knowledge matters, and what they learn today can help solve some of the biggest problems of tomorrow.”*

Founded in 2004, and based since November 2015 in the Department of Technology and Society at Stony Brook University in New York, the National Center for Science and Civic Engagement supports a community of more than 6,000 educators, administrators, and students from more than 500 two- and four-year colleges, universities, and, increasingly, informal education venues like science centers, zoos, and wildlife centers.

The National Center’s signature initiative is SENCER. It was born in the wake of the HIV/AIDS epidemic of the 1980s and 1990s, when Rutgers University Professor Monica Devanas developed a course that taught basic biology through a focus on that disease. By teaching standard general education biology course content “through” a complex public health challenge of immediate relevance, enrollments surged from a typical 125 to over 450 (filling the largest available lecture hall). This use of a pressing public problem to engage students and help them learn and retain complex biological concepts became the foundational strategy of SENCER, and was extended to all STEM disciplines and course levels, from general education to majors. Since that time, hundreds of courses, course modules, teaching guides, and curricular programs have

been developed, evaluated, and shared within the SENCER community, all focused on both improving STEM learning and building civic awareness and agency. Currently, there are more than 50 exemplary SENCER field tested “model” courses contributed by faculty in a full range of STEM disciplines. The Center has also spawned nine regional hubs and boasts other successful initiatives, including GLISTEN (Great Lakes Innovative Stewardship Through Education Network) and Engaging Mathematics.

Since its establishment, the National Center and its respective initiatives have received significant support from the National Science Foundation, the Noyce Foundation, the Keck Foundation, the Institute of Museum and Library Services, the National Endowment for the Humanities, and other funders.

SENCER has also developed an online assessment instrument, SENCER-SALG (Student Assessment of Learning Gains), which is aligned with SENCER project goals. Analysis by Senior Research Fellow Stephen Carroll noted that SENCER faculty out-performed non-SENCER colleagues in several dimensions, including changing attitudes toward science and building habits of mind and behavior. Carroll’s report concluded: *“the data clearly show that SENCER is improving science education and civic engagement across the nation, supporting the NSF’s STEM education goals”* (Carroll 2012). Currently, the Center conducts participant evaluation for all SENCER programs, including educator professional development programs and resources. In addition, the Center has convened a research and evaluation task force to identify or develop assessment instruments that address SENCER-specific learning outcomes and their contribution to the organization’s future research agenda.

THE SENCER IDEALS

Critical to SENCER are its Ideals, which put forth its philosophy and frame its pedagogical approach and community values. While they focus principally on “students” and therefore connect most readily with formal education, several recent projects have tested these ideals successfully in informal learning settings. In fact, the focus on the scientific method and scientific ways of knowing align several of these ideals with the Strands of Science Learning put forward in the National Research Council’s Learning Science in Informal Environments (2009).

THE SENCER IDEALS ILLUSTRATE THE PRINCIPLES AND PHILOSOPHIES THAT GUIDE SENCER'S APPROACH TO EDUCATIONAL PRACTICE:

- SENCER robustly connects science and civic engagement by teaching **“through”** complex, contested, capacious, current, and unresolved public issues **“to”** basic science.
- SENCER invites students to put scientific knowledge and the scientific method **to immediate use** on matters **of immediate interest to students**.
- SENCER helps **reveal the limits of science** by identifying the elements of public issues where science does not offer a clear resolution.
- SENCER **shows the power of science** by identifying the dimensions of a public issue that can be better understood with certain mathematical and scientific ways of knowing.
- SENCER conceives the intellectual project as **practical and engaged from the start**, as opposed to science education models that view the mind as a kind of **“storage shed”** where abstract knowledge may be secreted for vague potential uses.
- SENCER seeks to **extract from the immediate issues the larger, common lessons** about scientific processes and methods.
- SENCER locates the **responsibilities** (the burdens and the pleasures) **of discovery as the work of the student**.
- SENCER, by focusing on contested issues, encourages student **engagement with “multidisciplinary trouble”** and with civic questions that require attention now. By doing so, SENCER hopes to help students **overcome both unfounded fears and unquestioning awe of science**.

A COMMUNITY OF TRANSFORMATION

With the informal learning sector increasingly engaging in Communities of Practice (CoP), the results of recent research by Dr. Adrianna Kezar and Dr. Sean Gehrke of the Pullias Center for Higher Education in the Rossier School of Education at the University of Southern California are of interest. Kezar and Gehrke examined four STEM-focused, higher education, communities focused on advancing the goals of scaling STEM reform: BioQuest, Project Kaleidoscope, the POGIL Project, and SENCER (Kezar & Gehrke 2015). Their NSF-funded study looked at design and structural features of the four programs, the perceived benefits

of participation for both members and leaders, and the goals of affecting and spreading undergraduate STEM pedagogical change. Kezar and Gehrke concluded that these groups had developed an approach to STEM educational reform that they dubbed “communities of transformation” with their defining feature being a philosophical focus on exploring “in deep and fundamental ways, how science is taught” (p. i). Moreover, these communities of transformation “address both individual faculty and broader systemic change” (p.i), with an innovation “that is lived, a distributed community, and a practice” (p.20).

Higher Ed Partner	ISE Partner	Project
Antioch College	Glen Helen Outdoor Education Center	Biodiversity, invasive species, forest restoration
Brooklyn College - CUNY	Gateway National Recreation Area	Seashore plastic debris survey
Cornell University	Sciencenter	Parent support for early cognitive development
Fordham University	Wildlife Conservation Society	Urban ecology field research
Hamilton, Hope, and Oberlin College	Green Science Policy Institute	Analytical toxicology & public policy
New Mexico EPSCoR	NM Museum of Natural History & Science	Current S&T research network
Paul Smith's College	The Wild Center	Climate change gatekeepers
Raritan Valley Community College	New Jersey Audubon Center	Forest health citizen science
St. Mary's College of California	Lindsay Wildlife Museum	Urban habitat mobile app
University of Connecticut	Connecticut Science Center	Genome ambassadors

SENCER-INFORMAL SCIENCE EDUCATION (SENCER-ISE)

The intersection of SENCER and ISE was first explored at an NSF-funded invitational conference in 2011 that brought together representatives of Higher Education (HE) and Informal Science Education (ISE) to discuss possible strategies for working together based on a shared interest in civic engagement. The groundwork for that event was laid two years earlier by presentations comparing informal with formal learning at SENCER's Fourth Annual Science Symposium by the late Alan Friedman (then director, New York Hall of Science) and David Ucko (then NSF deputy division director). Those talks revealed that SENCER courses are grounded in key attributes of informal learning (Ucko 2015). Emphasis on societal issues makes the STEM content more relevant, increasing intrinsic motivation. SENCER

courses focus on the learner rather than simply transmitting academic content. Like many informal learning exhibits and programs, SENCER courses tend to be interdisciplinary since they address real world concerns.

The interest generated by the conference led to proposals supported by NSF and the Noyce Foundation to fund a set of ten partnerships, which in turn received mini-grants to fund their local initiatives, as well as centralized support from SENCER staff. As indicated in the table below, many of the individual projects focused on aspects of the environment as the civic issue. Further details can be found at <http://sencer-ise.net/partnerships>. Figures 1 through 4 illustrate several of the partnership initiatives.



Figure 1: Students surveying plastics along Jamaica Bay as part of the Sentinels of Shoreline Change project, a partnership of the National Park Service's Gateway National Recreation Area and Brooklyn College.



Figure 2: A Family Workshop at Sciencenter, part of "Science from the Start: Engaging Researchers, Graduates, and a Science Museum to Reach Early Learners and Set the Stage for STEM Learning," in partnership with Cornell University's Early Childhood Cognition Lab.



Figure 3: In “Genome Ambassadors,” the Connecticut Science Center partnered with the University of Connecticut to conduct surveys and develop hands-on activities based on genetics and genomics.

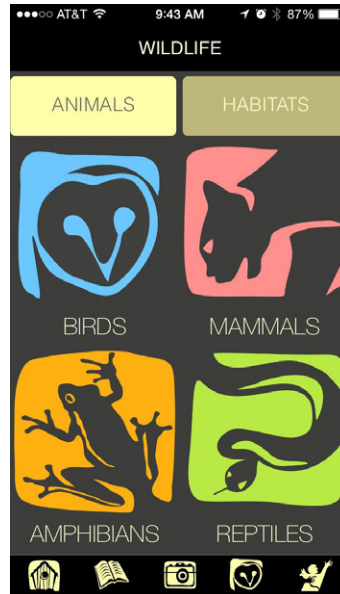


Figure 4: In “Facing the Future: Sharing Habitats with Wildlife,” students at Saint Mary’s College of California worked with Lindsay Wildlife Museum staff to develop and launch a free mobile app.

This pilot project demonstrated proof of concept. Eight of the ten partnerships completed their collaborative work around their selected issue of civic value, and most are continuing their relationships.

Based on a summative evaluation conducted by Randi Korn & Associates, the following factors were most important in creating durable HE-ISE partnerships:

- Sharing common goals and a “passion” for the project.
- Establishing clear and consistent communication.
- Connecting on a personal level to strengthen relationships beyond mutual respect.
- Planning at the outset to clearly define roles, responsibilities, and expectations.
- Reflective practice and openness to change that facilitate course correction as needed.
- Adequate resources that allow partners to contribute the necessary amount of time.

A National Leadership Grant from the Institute of Museum and Library Services (IMLS) supported five more partner-

ships in order to evaluate the impact of an additional element: experienced “eMentors,” mentors who would be in virtual communication with their designated partnership. The five eMentors, one assigned to each new partnership, were recruited from those who participated in the first SENCER-ISE partnership cohort.

Since this project is still underway, definitive conclusions cannot be provided. However, preliminary feedback indicates the importance of:

- Holding an in-person meeting of eMentors and partner mentees early in the project.
- Setting clear expectations and agreement on the role of the eMentor.
- Establishing a regular schedule for meetings via a chosen platform.
- Jointly creating an action plan and timeline for completion of project activities.
- Understanding and adapting to the respective organizational cultures and constraints of HE, ISE, and, in some cases, K-12.

Higher Ed Partner	ISE Partner	Project
Eastern Michigan University	Ann Arbor Hands-On Museum	Community needs assessment for collaborative programming
Lincoln Memorial University	Abraham Lincoln Library & Museum	Human geography & environmental history
Rider University	Stony Brook Millstone Watershed Assn	Water quality
Towson University	National Aquarium	Stewardship of aquatic environment
Wheelock College	Charles River Watershed Assn	Urban watershed quality

The potential for collective impact is being investigated in a related NSF-funded project based on possible cross-sector collaboration between SENCER and the National Informal STEM Education Network (NISE Net). In a March 2017 convening, representatives of both organizations, along with other key invited participants, explored the assets and structures of these two networks, along with the Portal to the Public Network (PoPNet), the Afterschool Alliance, the Hive Learning Network, and the Humanities Action Lab. It became clear that opportunities exist for SENCER to leverage its national resources and advance its strategy of linking STEM content to pressing civic challenges through strategic collaborations with other networks. It was also clear that doing so would not be easy and best accomplished in small but strategic steps. As a follow up, SENCER is conducting a national survey among network members to obtain feedback on possible next steps.

CONCLUSION

Collaboration between informal science organizations and higher education institutions based on civic engagement offers potential benefits for the partners, the students, and the public. ISE organizations gain access not only to faculty subject matter expertise but to undergraduates, a yet largely untapped STEM education resource and a potential audience. The colleges and universities gain access to public audiences and informal learning expertise. Those involved gain professional development, and both organizations benefit from greater involvement in their communities. For ISEs, these types of civic engagement partnerships provide a means to further their transition from “nice” to “necessary” by fostering public engagement with critical issues.

REFERENCES

- Carroll, S. 2012. *SALG results show SENCER faculty achieve in raising higher-order learning gains*. Retrieved from <http://ncsce.net/salg-results-show-sencer-faculty-achieve-in-raising-higher-order-learning-gains>.
- Kezar, A., & Gehrke, S. 2015. *Communities of Transformation and Their Work Scaling STEM Reform* (Rep.). Los Angeles, CA: Pullias Center for Higher Education, Rossier School of Education, University of Southern California.
- Kezar, A., Gehrke, S., & Bernstein-Sierra, S. 2017. Designing for success in STEM communities of practice: philosophy and personal interactions. *The Review of Higher Education* 40(2), 217-244.
- National Research Council. 2009. Learning science in informal environments: People, places, and pursuits. *National Academies Press*.
- Ucko, D. A. 2015. SENCER Synergies with informal learning. *Science Education and Civic Engagement* 7:2 16-19. <https://d32ogoqmya1dw8.cloudfront.net/files/secej/summer15/ucko.pdf>.

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INFORMAL LEARNING REVIEW SURVEY - PARTICIPATION REQUEST

In the hopes of serving you - our colleagues and Informal Learning Review readers - better, Informal Learning Experiences, in collaboration with Karen Wise of Wise Strategic Consulting, is seeking some feedback. Your responses to our survey will help us to shape the future of the Informal Learning Review. Our goal is to make it more relevant and interesting to you and your staff. The survey can be accessed at: <https://www.surveymonkey.com/r/CJYV8NS>.

We appreciate your taking the time to respond. We would also welcome any suggestions or requests. Please send them directly to us at ileinc@informallearning.com.