

GSEE, the Global Partnership for Science Education through Engagement: Background and Structure

Founding Premises GSEE was founded at the 2009 ICAM Annual meeting in Cambridge, England on the following premises:

- The public understanding of science and its role in society is a major global problem and improving that understanding can be a global multi-disciplinary effort.
- Major improvements in that public understanding become possible if significant numbers of research scientists and engineers engage with non-scientists at every level, from K-12 on.
- It follows that a global partnership can accelerate the global understanding of science and its role in society by coalescing, connecting, and expanding the community of engaged scientists and engineers across disciplines and borders, and providing them with the tools to make their work with students, educators, informal science education professionals, and the public more effective.
- It is timely to initiate ***experiments in engagement*** on a large scale by building regional, national, and global partnerships in the *engagement community* [research scientists and engineers in universities, the private sector and government, and their professional and honorary societies] that carry these out in collaboration with *the educational community* of teachers, informal science educators, and behavioral scientists.

Experiments in engagement Research scientists can and do play a myriad of roles in outreach and informal science education, from giving public talks to being involved in instructional materials development, and from running science festivals to offering research internships to students. At present there are only the beginnings of efforts to treat *engagement* by scientists with school-aged children and the public at large

as an experiment-based and empirical science, as compared to an art practiced on an individual basis. Moreover, because improving science education, outreach and communication at every level is a major *global* challenge and significant experiments in engagement are (and could be) carried out in many different countries, developing *engagement* as an experiment-based science is both important and desirable within the context of a global perspective. **GSEE** is itself an experiment in engagement—to see whether by sharing information and working together on major initiatives, scientists in leading educational institutions, scientific societies, science museums, and corporations, can accomplish far more than they can by working separately.

Founding Partners GSEE began under the auspices of ICAM, the Institute for Complex Adaptive Matter [<http://icam-i2cam.org>] with a group of thirteen ICAM branches [Kyoto University, National High Magnetic Field Laboratory, the Paris ICAM Consortium, Rutgers University, Sabanci University, Santa Fe Institute, University of California [Davis], University of California [San Diego], University of Cambridge, University of Chicago, University of Colorado [Boulder], University of Illinois [Urbana-Champaign], Wolf Ridge Environmental Learning Center] and the University of Pennsylvania serving as its initial *Founding Partners*. During 2012, the number of GSEE Founding Partners has expanded significantly to include 33 institutions, with the AAAS, the National Academy of Sciences, American Institute of Physics, American Association of Physics Teachers, the American Physical Society, the Exploratorium, FermiLab, the International Institute for Applied Systems Analysis, the Koshland Museum, MIT, Northern Illinois University, and the Science Academy [Istanbul] joining six other ICAM branches [Argonne National Laboratory, Hong Kong University of Science and Technology, Northwestern University, University of Buenos Aires, University of Utrecht, Zhejiang University] as Founding Partners.

GSEE is in the process of expanding this group of Founding Partners to include corporations, additional leading science museums, media leaders, other major universities, additional honorary and professional societies, charter schools, citizen-science organizations, and other “grassroots” groups. A brief description of GSEE’s initial activities may be found at <http://icami2cam.org/index.php/outreach/gsee/>.

Becoming a GSEE Founding Partner is simple: it requires only a shared interest in our goals plus having one or more key members of your institution who agree to work with GSEE to explore potential synergies between the Partner’s activities and those of GSEE, and to keep both groups informed of existing and planned activities that are of mutual interest. Founding Partners are invited to nominate members of GSEE working groups, to send representatives to exploratory workshops, to participate in GSEE Founding Summits, and to join in other GSEE activities.

GSEE Strategy and Plans

* Use our skills and influence to get more scientists, at every level of their careers, engaged in science education and give them the tools and guidance to do so effectively.

*Work with our most prestigious senior colleagues to raise the stature of outreach/public engagement/informal science education so that an early career scientist can receive institutional backing and advance professionally through a scholarly and active approach to outreach.

*Develop a global *Engagement Registry*-a list of *experiments in engagement*

carried out or proposed by members of the GSEE community as part of our effort to help engaged scientists communicate and collaborate with one another and with formal and informal science educators across traditional boundaries

*Ask: What are the *Grand Challenges in Engagement*?—the major problems that need to be addressed in order to enhance substantially the number of scientists who actively participate in science education, outreach and communication, and make their *engagement* more effective and impactful.

*Carry out new *experiments in engagement* that focus on scalable and sustainable concepts and practices and realistic assessment protocols; *act locally, but think globally*

*Consider creating a *Science of Engagement* as one of our long-term goals

GSEE Structure GSEE is moving forward under a hub and spoke structure with Founding Partners who collaborate via a mix of working groups, workshops, and experiments -- pilot programs that involve physical and life scientists from a broad range of institutions. In convening the Founding Summit, GSEE/Chicago, The University of Chicago acted as the de-facto GSEE hub and it is continuing to do so. The initial proposed US spokes are:

*GSEE/Illinois, a “mini-hub” initially centered at UChicago, whose spokes will include Northwestern, UIUC, NIU, UIC, Argonne, and Fermilab

*ICAM, another “mini-hub”, whose 19 spokes are its branches that became GSEE Founding Partners through their active programs in science education

*American Association for the Advancement of Science.

*National Academy of Sciences

*American Association of Physics Teachers

*American Institute of Physics

*Forum on Outreach and Engaging the Public and other engagement programs of the American Physical Society

The initial GSEE spokes outside the US are:

*GSEE/Japan, with hubs at the Tokyo University of Science and Kyoto University

*The Science Academy [Istanbul]

GSEE Founding Summits

GSEE/Chicago [May 9-11, 2013]. Twenty-five engaged participants from Illinois, California, and Washington, DC met for two days to review progress on national and local experiments in engagement as part of an examination of the broader purpose of engagement with schools, to propose a GSEE structure and initial working groups, and to found GSEE/Illinois as a template for local and regional GSEE consortia--groupings in which leading innovators develop

collaborative efforts in outreach/public engagement/informal science education.

GSEE/Kyoto [Oct.20-23, 2013] Forty-six engaged participants from Japan, China, Korea, the US, France, and Turkey met for 2 ½ days to establish GSEE/Japan as a regional GSEE consortium with offices in Kyoto and Tokyo. They exchanged information on their experiments in engagement and initiated work on developing pilot projects for regional consortia including new joint experiments and an engagement registry that will begin with entries by Summit participants.

GSEE/Taipei [Fall. 2014], GSEE/Beijing [Fall, 2015], and GSEE/Cambridge are in the planning stage.

Working Groups Four working groups were formed at GSEE/Chicago to develop pilot programs and propose funding mechanisms to carry these out.

Developing GSEE/Illinois is a working group/consortium involving UChicago, Northwestern, UIC, Argonne, Fermilab, NIU, and UIUC: Co Chairs, Michael Lach [Chicago] and Patricia Sievert [NIU]. The group expects to re-form the area-wide Joint Education Committee (JEC) that includes the above institutions in order to develop a model for regional attempts to connect professional scientists with STEM educators and students. GSEE/Illinois is considering, as an initial pilot project, providing every school in selected local municipalities with at least one STEM engagement opportunity utilizing engaged practitioners from outside institutions. The interface with school systems (e.g., Chicago Public Schools) will require appreciation of teachers' needs and expectations, as well as curricular requirements. Following this scoping exercise, GSEE/Illinois could be in a position to develop a compelling funding proposal to create a national network of similar committees. Endeavors such as these require sustained financial and scientific resources as well as methodological rigor.

Communications. Two working groups – one on national and global initiatives, chaired by Philip [Bo] Hammer [AIP], and one on regional initiatives, chaired by Peter Littlewood [Argonne] -- have begun work.

The Hammer group held its first meeting at the Washington office of the American Chemical Society on August 22, 2013. Present were representatives from the National Academies, AAAS, AAPT, AIP, APS, ACS, ICAM, UIUC, UC Davis, and CAISE. They discussed a *unified communications hub/portal/magazine/journal* that would have the following components:

* an online refereed journal that will contain reports on “Experiments in Engagement” that are intended to connect and inform the community of engaged scientists

*using arXiv to include preprints of such reports

- * a curated portal that connects blogs by engaged scientists and expand their number significantly.
- * a web site that might serve as a National Engagement Registry and Resource

The group held a second meeting on October 8, following which they issued a draft white paper that was discussed at GSEE/Kyoto and will be made public in the coming months.

Peter Littlewood has started work with Argonne and UChicago colleagues to get a regional communication hub [STEMware?] started with information about practices of GSEE/Illinois partners that could then be expanded to include others in the region. The hub will be a web-based clearinghouse for engagement with a focus on connectivity. It could:

- * link best practices and individuals from different organizations;
- * provide peer review of content (verification and validation of activities) via a moderated blog or a stamp of excellence, etc.;
- * support the development of platforms for delivery of engagement;
- * present a suite of methodologies for measuring success of activities; and
- * house a data archive of research results on engagement efforts, their administration, and assessment.

Defining “Grand Challenges in Engagement” and proposing Exploratory Workshops to discuss and devise ways to meet these: Co-Chairs, David Pines [Davis] and Martin Storksdieck [National Academies]. The working group met electronically to prepare an initial report in time for its discussion during the GSEE/Kyoto Summit; there was agreement there on the global nature of the following proposed initial grand challenges

Grand Challenge 1 Build, expand, and sustain a community of *engaged scientists* within and across the disciplines by providing better opportunities for natural and physical scientists to involve themselves in education, outreach and communication, with the long-term goal of creating a *science of engagement*, and in so doing, change the culture of science.

Grand Challenge 2 Establish major new programs to enhance significantly opportunities for engagement by scientists in schools, after-school and informal settings.

Grand Challenge 3 Involve research scientists in the current revolution of technology-enabled learning to render these opportunities meaningful for science teaching and learning.

Grand Challenge 4 Find effective ways to encourage students of STEM disciplines to include education, outreach and communication as a

significant component of an engaged career path, or as a career path in itself.

GSEE Executive Committee The GSEE Executive Committee is made up of Founding Summit Chairs, Working Group Chairs, and the leaders of its major hubs and spokes. Its Co-Chairs are David Pines and Thomas Rosenbaum; its present membership is:

- *Akito Arima, Chancellor, Musashi Gakuen, Past-President University of Tokyo
Director, GSEE/Japan
- *Beth Cunningham, *Executive Director, American Association of Physics Teachers*
- *Hong Ding, Managing Director and Chief Scientist, Institute of Physics, Chinese Academy of Sciences *Chair, GSEE/Beijing*
- *Laura Greene, Swanland Professor of Physics, UIUC, *Chair, ICAM Board of Governors*
- *Philip [Bo] Hammer, Associate Vice-President, American Institute of Physics,
Chair, Working Group on Global Communication
- *Michael Lach, Director of STEM Policies and Strategic initiatives, Urban Education Institute, University of Chicago *Co-Chair, Working Group on Developing GSEE/illinois*
- *Peter Littlewood, Associate Director, Argonne National Laboratory, *Chair, Working Group on Regional Communication*
- *Tiffany Lohwater, *Director of Meetings and Public Engagement, AAAS*
- *Kazuo Kitahara, Professor of Physic and Science Education, Tokyo University of Science, *Director, GSEE/Tokyo*
- *Kazuo Nishimura, Professor of Economics, Kobe University and Kyoto University, *Director, GSEE/Kyoto*
- *David Pines, Founding Director Emeritus, ICAM, Co-Founder Santa Fe Institute, Distinguished Research Professor of Physics, UC Davis, *Co-Chair, Working Group on Grand Challenges in Engagement*
- *Lord Martin Rees, Astronomer Royal, Past President, Royal Society, and *Chair, GSEE/Cambridge*
- *Thomas Rosenbaum, Provost, University of Chicago, *Co-Chair GSEE/Chicago Founding Summit*
- *Patricia Sievert, Director of STEM Outreach, Northern Illinois University, *Co-Chair, Working Group on Developing GSEE/Illinois*
- *Martin Storksdieck, Director, Board on Science Education, National Academies, *Co-Chair Working Group on Grand Challenges in Engagement*
- *Maw-kuen Wu, President National Dong Hwa University, *Chair, GSEE/Taipei*

Concluding remarks There is no unique path to enhancing engagement and measuring its effectiveness. Rather one should try a number of different approaches while searching for synergies between them. GSEE is accordingly encouraged to consider the merits and staging of a proposal to carry out a

number of experiments in engagement based on the concepts examined in these working groups and exploratory workshops.

Looking further ahead, once success is achieved locally, a regional model, or models across multiple localities, may be launched to demonstrate scalability and test the functional reach of the ideas proposed here. Ultimately, the goal is for GSEE to stand solidly as a recognized resource for readily available, current and high quality information and results on STEM engagement and other ways to enhance science literacy.