Background information and Progress Report on GSEE, the Global Partnership for Science Education through Engagement

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

*****Major improvements in science literacy become possible if significant numbers of research scientists and engineers *engage* in educating non-scientists at every level, from K-12 on, about science

*Now is the time to initiate *experiments in engagement* on a large scale by building new partnerships in the *engagement community* of research scientists and engineers in universities, the private sector and government, and their professional and honorary societies, to carry these out in collaboration with the *educational community* of teachers, informal science educators, and behavioral scientists.

*Science literacy is a major global problem and education about science can become a global multi-disciplinary effort.

*It follows that a global partnership can accelerate global science literacy by connecting, coalescing, and expanding the community of engaged scientists and engineers across disciplines and borders, and providing them with the tools to make their work more effective.
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* with school-aged children and the public at large by scientists 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.

Experiments in science engagement that involve active scientists and researchers occur within the larger context of science outreach, formal and informal education, and communication, and less so as an extension of traditional science education research. The sector of science outreach, informal education, and communication that is lead by, or at least utilizes natural and

physical scientists also involves institutions that organize such science engagement efforts, from community-based organizations to afterschool programs and science clubs to science centers and museums, professional societies and institutions of higher education. *Experiments in science engagement* are therefore not only about ways in which researchers can professionalize their outreach efforts through empirical research and evaluation; it also involves the entire community of professionals who work in science engagement (be that formal or informal) and who involve scientists in their work.

GSEE is itself an experiment in engagement—to see whether by sharing information and working together on major initiatives, scientists working with their colleagues in leading educational institutions, scientific societies, science museums, and corporations, can accomplish far more than they can by working separately. Its goals are to inspire more working scientists to become engaged in science education at every stage in their careers, and to give them the tools and guidance to do so effectively.

Founding Partners GSEE began under the auspices of ICAM, the Institute for Complex Adaptive Matter [http://icam-i2cam.org] with a group of eleven ICAM branches serving as its *Founding Partners*. During the past year, the number of GSEE Founding Partners has expanded significantly, with the AAAS, the National Academy of Sciences, American Institute of Physics, American Association of Physics Teachers, the American Physical Society, the Exploratorium, and the International institute for Applied Systems Analysis joining ICAM, seven other ICAM branches, and five other institutions as Founding Partners.

The requirements for an organization or institution to become a GSEE Founding Partner are simple: a shared interest in our goals plus having one or more key members 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 is in the process of expanding the group of Founding Partners listed below to include corporations, additional leading science museums, media leaders, other major universities, honorary and professional societies, 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/.

• The Institute for Complex Adaptive Matter (ICAM)

• American Association of the Advancement of Science
• American Association of Physics Teachers
* American Institute of Physics
• American Physical Society
• Argonne National Laboratory
* Exploratorium
• FermiLab
* International Institute for Applied Systems Analysis
• Koshland Museum
• Kyoto University
• MIT
• National Academy of Sciences
• National High Magnetic Field Laboratory/FSU
• Northwestern University
• Paris ICAM Consortium [Triangle de Paris]
• Rutgers University
• Sabanci University (Istanbul)
• Santa Fe Institute
* Science Academy [Istanbul]
• University of Buenos Aires
• University of California, Davis
• University of California, San Diego
* University of Cambridge
• University of Chicago
• University of Colorado, Boulder
• University of Illinois, Urbana-Champaign
• University of Pennsylvania
• University of Utrecht

• Wolf Ridge Environmental Learning Center

• Zhejiang University (ZJU), Hangzhou

GSEE Strategy and Plans

* Use our skills and influence to get more scientists engaged, at every level of their careers, in science education and to 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 proposed that it continue doing 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 spokes will include its branches that decide to nucleate Regional Consortia [currently Kyoto and Beijing] and possibly soon, Boston, Boulder, Cambridge [England], Istanbul, Paris, and Seoul].

*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

GSEE plans to add additional US professional societies as national spokes, and, as these develop, additional regional mini-hubs.

The initial GSEE spokes outside the US are:

GSEE/Kyoto, a mini-hub centered at the University of Kyoto
The Science Academy [Istanbul]

It is expected that following GSEE/Kyoto, the GSEE Asian regional summit to be held from Oct.20-23, 2013, these will be joined by GSEE/Beijing, GSEE/Mumbai, GSEE/Seoul, and GSEE/Taipei, and, in the near future, GSEE/Paris and GSEE/Cambridge.

Working Groups Four working groups were formed at GSEE/Chicago to develop pilot programs and propose the 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 and develop a model for other regional attempts to connect professional scientists with STEM educators and students. As an initial project, GSEE/Illinois might strive to provide every school in selected local municipalities with at least one STEM engagement opportunity with 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.

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 group is meeting electronically to prepare an initial report by mid-October, 2013, in time for the GSEE/Kyoto Summit [Oct, 20-23, 2013]. Some grand challenges under consideration by the working group are listed separately below.

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 is meeting electronically and will meet physically on Oct.8, 2013 to continue its work on preparing a white paper.

Peter Littlewood has started work with Argonne and UChicago colleagues to get a 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.

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] A Regional Founding Summit that will identify Kyoto University as the GSEE/Kyoto lead campus, and discuss ways of coalescing the Japanese and Asian engagement communities. Participants at the summit will include leading engaged scientists from Japan, China, Korea, the US, France, and Turkey. They will exchange information on their experiments in engagement and initiate work on developing pilot projects for regional consortia including an engagement registry that will begin with entries by Summit participants.

Grand Challenges in Engagement

Four grand challenges under consideration by the GSEE working group are the following:

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: Finding 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.

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.