

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Annual Report – Year Four

Strengthening the Professoriate @ Iowa State University

Report Period: 1 July 2013 – 30 June 2014

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SP@ISU
Strengthening the Professoriate

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I. Executive Summary

The mission of Strengthening the Professoriate at Iowa State University (SP@ISU) is to support faculty as they develop Broader Impact (BI) activities for NSF proposals, integrate these activities into their research program, and document their BI work for the promotion and tenure process. Postdoctoral scholars and advanced graduate students also participate as they prepare their professional credentials for the professoriate. The outcome for SP@ISU will be more competitive NSF proposals, a new generation of faculty who integrate BI work into their research programs, and increased participation of those traditionally underrepresented in STEM, all outcomes that will strengthen the professoriate.

SP@ISU has built upon its strengths during year 4. We continued to facilitate networking on campus to assist, mentor, and support PIs in developing broader impacts plans. We offered workshops and participated in college level meetings as a means to provide information to faculty and facilitate networking among faculty and staff. SP@ISU also expanded its dissemination of resources and results to new communities during year 4. It has also promoted networking nationally, collaborating on a proposed NSF research coordination network and the second broader impacts infrastructure summit.

Significant accomplishments in Year 4 include:

- Enhanced program visibility
- Website improvements, including a new partner program search feature
- Continued successful programming to facilitate the development of well-researched broader impacts plans
- Well-respected project team that has been responsive to requests, including those requiring customizing information to different audiences
- Establishing a national presence and leadership role with respect to broader impacts efforts
- Preliminary evidence suggesting SP@ISU is helping to create a “broader impacts culture” at Iowa State, especially with respect to growing awareness of the importance of broader impacts as part of a successful research enterprise

II. Participants

II.A. People

David Oliver, Principal Investigator
Interim Vice President for Research and Economic Development
Nearest person month worked: 1

Dr. Oliver represents the program at the highest administrative level to ensure recognition of the importance and strategic implications of broader impacts at the university.

Bonnie Bowen, Co-Principal Investigator
Adjunct Assistant Professor of Ecology, Evolution, and Organismal Biology
Nearest person month worked: 2

Dr. Bowen participated in all program planning and meetings. Being the former Executive Director of ISU ADVANCE, she has provided a link to broadening participation activities on campus and is integral in the appointment and training of the college Equity Advisors.

Diane Rover, Co-Principal Investigator and SP@ISU Director
Professor of Electrical and Computer Engineering
Nearest person month worked: 2

In addition to being a Co-PI on the project, Dr. Rover is also the Director for SP@ISU. She is responsible for implementing directives that result from PI Team meetings and Executive Steering Committee meetings. She is also responsible for development and planning of all training opportunities for faculty, evaluation efforts, and SP@ISU events. She also serves as the link to faculty on campus.

Mack Shelley, SP@ISU Team Member
Professor of Statistics and Political Science
Faculty Fellow for Department Chair Professional Development
Nearest person month worked: 1

Dr. Shelley joined the leadership team in January. He has represented SP@ISU at a number of meetings and conferences. He brings evaluation and data management experience to the team.

Megan Heitmann, SP@ISU Assistant Director
Nearest person month worked: 12

Ms. Heitmann provides support to all aspects of the SP@ISU program. She assists in scheduling and providing agendas for meetings, maintaining the website, drafts reports and memos, organizes program workshops, and supports faculty who are preparing proposals.

Jonathan Wickert, Chair of the Executive Steering Committee

Senior Vice President and Provost

Nearest person month worked: 0

Dr. Wickert was appointed as Senior Vice President and Provost at the end of July 2012. He assumed the role of chairperson for the SP@ISU Executive Steering Committee and plays an active role in recognizing the scholarship of broader impacts.

Sarah Nusser

Vice President for Research

Nearest person month worked: 0

Dr. Nusser was named the Vice President for Research in February. She represents the program at the highest level at the university. SP@ISU is in the process of naming Dr. Nusser PI of the project.

Mari Kemis, Interim Internal Assessment Coordinator

Assistant Director, Research Institute for Studies in Education

Nearest person month worked: 0

Ms. Kemis served as the interim Internal Assessment Coordinator until September 2013. She provided access to and assessment of all relevant ISU databases and assists in the development of the program's formal evaluation plan. Ms. Kemis also serves on the Advisory Council.

Lian Niu, Internal Assessment Coordinator

Academic Data Analyst, Office of the Senior Vice President and Provost

Nearest person month worked: 0

Dr. Niu was hired in September 2013 by the Office of the Vice President and Provost. As part of her duties she took over as the Internal Assessment Coordinator for SP@ISU. She provides access to and assessment of all relevant ISU databases and assists in the development of the program's formal evaluation plan.

II.A.1. Equity Advisors

Equity Advisors (EAs) are appointed in the five STEM colleges and guide the development of a broader impacts culture among faculty, post-doctoral scholars, and students. They also provide a valuable connection between the SP@ISU program and college administration. The EAs who served during the third year of SP@ISU include:

Susan Lamont, Equity Advisor in the College of Agriculture and Life Sciences

Charles F. Curtiss Distinguished Professor of Animal Science

Nearest person month worked: 0

Lisa Larson, Equity Advisor in the College of Liberal Arts and Sciences

Professor of Psychology

Nearest person month worked: 0

Catherine Logue, Equity Advisor in the College of Veterinary Medicine

Professor of Vet Microbiology and Preventive Medicine

Nearest person month worked: 0

II.A.2. Faculty Leaders

Faculty Leaders (FLs) serve as role models and support networking initiatives among faculty and staff to build a culture of broader impacts at Iowa State. Each FL has expertise in an area of broader impacts and works to advance ISU's initiatives in these areas and build a community of experts around them.

Faculty Leaders 2013 – present

Fredric Janzen

Professor of Ecology, Evolution & Organismal Biology

Nearest person month worked: 1

Alejandro Travesset

Professor of Physics & Astronomy

Nearest person month worked: 0

Faculty Leaders 2011-2013

Holly Bender

Associate Director, Center for Excellence in Learning and Teaching;
Director, Preparing Future Faculty and the Graduate Student Teaching Certificate

Professor of Clinical Pathology in the College of Veterinary Medicine

Jean Goodwin

Associate Professor of English

Faculty member involved in Science Communication @ ISU

Michael Kessler

Associate Professor of Materials Science and Engineering

Left for Washington State University in 2013

II.A.3. Advisory Council Members

- Joe Colletti, Senior Associate Dean, College of Agriculture and Life Sciences
- Lora-Leigh Chrystal, Director, Program for Women in Science and Engineering
- Michael Dahlstrom, Assistant Professor, Greenlee School of Journalism and Mass Communications
- Malika Jeffries-EI, Associate Professor, Department of Chemistry
- Mari Kemis, Assistant Director, Research Institute for Studies in Education
- Sandra Norvell, Grants Coordinator, Office of the Vice President for Research
- Craig Ogilvie, Assistant Dean, Graduate College
- Carla Peterson, Associate Dean, College of Human Sciences

- Chitra Rajan, Associate Vice President for Research
- Raj Raman, Professor and Associate Chair for Teaching, Department of Agriculture and Biosystems Engineering; University Education Program Director, Center for Biorenewable Chemicals
- Arun Somani, Associate Dean for Research, College of Engineering
- Martin Spalding, Associate Dean, College of Liberal Arts and Sciences
- Jay Staker, Extension Youth Development Specialist, 4-H Youth Development
- Qijing Zhang, Associate Dean, College of Veterinary Medicine

II.A.4. Undergraduate Students

The undergraduate students assist the SP@ISU staff with basic office tasks, compiling and drafting written pieces, and updating the website.

Kayla Greiner

Nearest person month worked: 2

II.B. Collaborators

II.B.1. External Evaluation Consultant, Dr. Mariko Chang

Dr. Chang provides the external perspective to SP@ISU activities. She has developed the program's formal evaluation plan, works with the Internal Assessment Coordinator to implement this plan, and performed formal program evaluation for year 1 of the project.

II.B.2. EPSCoR Broader Impacts Platform Leader, Sriram Sundararajan

Dr. Sundararajan is an Associate Professor in Mechanical Engineering, the Equity Advisor in the College of Engineering, as well as the Broader Impacts Platform Leader for Iowa EPSCoR. He provides valuable connections between SP@ISU and Iowa EPSCoR, as well as the College of Engineering administration.

II.B.3. SP@ISU Workshop Presenters

Broader Impacts Text Analysis Workshop

Presenter

Elena Cotos, Linguistics Researcher, Graduate College

Data Management Planning

Presenters

Bonnie Bowen, SP@ISU Co-PI

Megan O'Donnell, Scholarly Communications Librarian

Spring 2014 Brown Bag Lunch Series

Broader Impact Activities in CAREER Proposals Speakers

Alex Travesset, Associate Professor, Physics and Astronomy

Mayly Sanchez, Associate Professor, Physics and Astronomy

Aditya Ramamoorthy, Associate Professor, Electrical and Computer Engineering

Your Broader Impacts Questions Answered Speakers

Diane Rover, Professor of Electrical and Computer Engineering and SP@ISU Director

Bonnie Bowen, SP@ISU Co-PI

Megan Heitmann, SP@ISU Assistant Director

Working in K-12 for Broader Impacts Speakers

Fredric Janzen, Professor of Ecology, Evolution, and Organismal Biology

Adah Leshem, Pre-College Education Programs Director, NSF Center for Biorenewable Chemicals

Fourth Iowa State University Summer Symposium on Science Communication

Advancing Broader Impacts: Theory and Practice Session

Presenters:

Megan Skrip, University of Rhode Island, *Assessing the Broader Impacts of Ecological Research: Towards a "Broader Impacts Impact Factor"*

Michael Dahlstrom, Iowa State University, *Doing Broader Impacts?: The National Science Foundation (NSF) Broader Impacts Criterion and Communication-Based Activities*

Melanie Roberts, AAAS, *Respondent*

II.B.4. SP@ISU Partner Programs

The SP@ISU project collaborates with a number of ISU internal organizations and departments to share information and programming. These programs have worked on collaborative projects, participated in collaboration meetings, and presented at SP@ISU workshops. The SP@ISU partners include:

- Ames Laboratory
- Biotechnology Outreach Education Center (BOEC)
- Center for Excellence in Science, Mathematics, and Engineering Education (CESMEE), College of Human Sciences
- Center for the Integration of Research, Teaching, and Learning (CIRTL)
- Engineering Precollege Programs
- Future Leaders in Advancing Renewable Energy (FLARE) Institute
- George Washington Carver Internship Program, College of Agriculture and Life Sciences
- Graduate College
- Graduate Research Assistantship Match (GRAM), College of Agriculture and Life Sciences
- Howard Hughes Medical Institute Project (HHMI)
- Iowa EPSCoR

- Iowa Illinois Nebraska STEM Partnership for Innovation in Research and Education (IINSPIRE-LSAMP)
- Iowa Space Grant Consortium
- ISU ADVANCE
- ISU Extension – 4-H
- ISU Honors Program
- IT-Adventures
- Mathematics Department
- Molecular Biology, Biotechnology and Genomics Departments
- NSF Engineering Research Center for Biorenewable Chemicals (CBiRC)
- Office of Community College Research and Policy (OCCRP)
- Plant Genomics Education Outreach
- Preparing Future Faculty (PFF)
- Program for Women in Science and Engineering (PWSE)
- Psychology in Education Research Lab (PERL)
- Research Experience for Undergraduates (REU) Programs (various)
- Research Institute for Studies in Education (RISE)
- SACNAS Chapter: Devoted to Advancing Hispanics, Chicanos and Native Americans in Science
- Science Bound
- Science Communication @ ISU
- Student Enrollment and Engagement through Connections (SEEC), College of Engineering
- Summer Program for Enhancing Engineering Development (SPEED)
- Survey and Behavioral Research Services
- Toying with Technology
- Four TRiO Programs

More information about each of these partners is available at the SP@ISU website, www.spisu.iastate.edu/programs.

II.B.5. SP@ISU External Partners

Research Coordination Network Proposal

Individuals involved in writing the NSF proposal “RCN: Broader Impacts and Outreach Network for Institutional Collaboration (BIONIC)”

- Susan Renoe, PI
Director, Broader Impacts Network, University of Missouri
- Jane Horwitz, Co-PI
Director, Science Outreach Initiative, University of Pennsylvania School of Arts and Sciences
- Kemi Jona, Co-PI
Director, Office of STEM Education Partnerships, Northwestern University

- Kevin Niemi, Co-PI
Program Manager, Institute for Biology Education, University of Wisconsin
- Diane Rover, Co-PI
Director, SP@ISU, Iowa State University
- Megan Heitmann, Key Personnel
Assistant Director, SP@ISU, Iowa State University
- Amy Pratt, Key Personnel
Associate Director, Office of STEM Education Partnerships, Northwestern University
- Kaye Storm, Key Personnel
Director, Office of Science Outreach, Stanford University

Broader Impacts Infrastructure Summit

The following is a list of institutions that were represented at the 2014 Broader Impacts Infrastructure Summit in Arlington, Virginia. The summit was an opportunity for professionals to share promising practices, to discuss the future of the national broader impacts community, and, most importantly, to dialogue about the future of broader impacts.

- American Association for the Advancement of Science (Washington D.C.)
- American Center for Physics (Maryland)
- American Institute of Biological Sciences (Virginia)
- American Society for Biochemistry and Molecular Biology (Maryland)
- American Society for Microbiology (Washington D.C.)
- Boston University (Massachusetts)
- Brown University (Rhode Island)
- Carnegie Mellon University (Pennsylvania)
- Center for Advancement of Informal Science Education (Washington D.C.)
- Danforth Plant Science Center (Missouri)
- Edu Inc. (Florida)
- Florida Conservation Association
- Ghent University (Belgium)
- Indian River State College (Florida)
- Institute for Broadening Participation (Maine)
- Iowa State University
- Kent State University (Ohio)
- Lewis-Burke Associates LLC (Washington D.C.)
- Massachusetts Institute of Technology
- Maine EPSCoR
- McWane Science Center (Alabama)
- Michigan State University
- Mississippi EPSCoR
- Missouri Botanical Garden

- Museum of Science (Massachusetts)
- National Academy of Sciences (Maryland)
- National Evolutionary Synthesis Center (North Carolina)
- National Science Foundation EPSCoR (Virginia)
- National Science Foundation (Virginia)
- New Mexico State University
- Northwestern University (Illinois)
- Northeastern University (Massachusetts)
- Oklahoma EPSCoR
- Oregon State University
- Pacific Science Center (Washington)
- Penn State University
- Rice University (Texas)
- Rochester Institute of Technology (New York)
- Rutgers University (New Jersey)
- Smithsonian National Museum of Natural History (Washington D.C.)
- South Dakota State University
- Stanford University (California)
- Texas A&M University
- The Study Group Inc.
- University of Alaska, Fairbanks
- University of California- Berkeley
- University of California – Merced
- University of California – Santa Barbara
- University of California – Santa Cruz
- University of Florida
- University of Massachusetts- Amherst
- University of Maine
- University of Missouri
- University of New Mexico
- University of North Carolina at Chapel Hill
- University of Oklahoma
- University of Oregon
- University of Pennsylvania
- University of Pittsburgh
- University of Rhode Island
- University of Tennessee
- University of Utah
- University of Virginia
- University of Wisconsin- Madison
- Virginia Institute of Marine Science
- Virginia Tech

- Wisconsin Energy Institute
- Yale University (Connecticut)

III. Activities

III.A. Overview of Project

SP@ISU is funded by a 5-year award received from the NSF Innovation through Institutional Integration (I³) program in 2010 (<http://NSF-i3.org>). Additional institutional support comes from the Office of the Senior Vice President and Provost and the Office of the Vice President for Research. SP@ISU is a community-based, integrative initiative to support faculty and the university in the planning, implementation, and evaluation of broader impacts (BI) work in concert with research.

SP@ISU is organized around four goals:

1. Build on current NSF programs to increase efficiency and effectiveness of ISU programs to broaden participation in STEM
2. Create a clearinghouse of programs, resources, information, and a network of people to assist and guide in the development of a broader impacts culture at Iowa State University
3. Facilitate and enhance the knowledge base needed by faculty to develop well-researched broader impacts plans as part of their research enterprise
4. Develop protocols for assessment and evaluation of a faculty member's broader impacts initiatives for inclusion in the promotion and tenure process

These goals are the basis for an SP@ISU logic model that guides project management.

Key Activities for Year 4

Several key activities for year 4 of the project continued from prior years, including efforts aimed at program visibility and networking, faculty involvement and information sharing, and planning and evaluation. Activities also focused on understanding progress toward a sustainable BI infrastructure and culture at Iowa State. With the national BI community emerging near the end of year 3, SP@ISU collaborated on new network development activities during year 4 with several other institutions, including planning and facilitating the second national/international BI infrastructure summit.

III.B. Program Visibility and Networking

To build on the momentum and progress to date, the fourth year emphasized continued program visibility on campus and nationally, the participation of tenured faculty, and gaining support for faculty recognition of broader impacts activities. Many of the activities

that improved SP@ISU visibility also created or strengthened networks among key groups of people involved in our program activities.

III.B.1. Presentations to Key Campus Groups

Meetings and Activities for the Office of the Senior Vice President and Provost

SP@ISU presented at and participated in a number of activities run through the Office of the Senior Vice President and Provost. Information on these is listed below.

New Faculty Orientation – August 21, 2013

SP@ISU hosted a table during a round-table discussion session of the New Faculty Orientation. Those attending were tenured and tenure eligible faculty who were new to the university.

Strategies for Obtaining Tenure: Panel Discussion – April 25, 2014

A panel of senior faculty shared tips for strategies to earn tenure with junior colleagues. Diane Rover, representing SP@ISU, offered information on how to present broader impacts work in a promotion and tenure package.

College Level Meetings

SP@ISU was asked by administrators from three colleges to present at lunch and learn sessions for researchers. Information on these sessions is below.

College of Liberal Arts and Sciences – August 22, 2013

At the recommendation of associate dean, Martin Spalding, SP@ISU team members presented at a college cabinet meeting. The cabinet consists of the Dean of the college and the department chairs. Following this presentation, SP@ISU was asked by chairs to present at two department meetings as well.

College of Design - January 17, 2014

Organized by the Center for Excellence in Arts and Humanities, attendees were researchers who are planning on submitting proposals.

College of Agriculture & Life Sciences – February 13, 2014

Organized by the College of Agriculture and Life Sciences research office, attendees were researchers interested in submitting proposals.

CALS Diversity Committee – February 19, 2014

The diversity committee is comprised of faculty and staff and charged with advancing diversity initiatives in the college. At this meeting, the committee learned more about SP@ISU, and SP@ISU learned about diversity programs and priorities in the college.

III.B.2. Equity Advisors and Faculty Leaders

In Year 4, the Equity Advisors (EAs) and Faculty Leaders (FLs) continued to engage with colleagues to guide the development of a broader impacts culture at ISU. EAs address specific needs in their respective colleges, and often work with college and department diversity and faculty search committees. An FL has experience in an area of BI, shares this with others, and facilitates BI networking and planning. Original Faculty Leaders rotated out in Year 4 of the grant and two new Faculty Leaders rotated in. The new FLs have expertise in developing research programs that involve K-12 students, developing high school teacher trainings, and incorporating activities seamlessly into research efforts. The past faculty leaders continued to promote SP@ISU through their regular responsibilities, including graduate student and postdoc training and science communication.

III.C. Faculty Involvement and Information Sharing

Increasing faculty involvement, by senior as well as early career faculty, is essential for SP@ISU to cultivate change on campus. SP@ISU has facilitated interactions among faculty members, among various programs, and between faculty and programs. The following meetings were organized by SP@ISU during year4. Selected attendance statistics are given later in this report and in the External Evaluation Report.

III.C.1. Broader Impacts Text Analysis Workshop

November 14, 2013

Work was initiated in Year 3 with Dr. Elena Cotos, a linguistics researcher at ISU, to use corpus linguistics techniques to analyze the content of broader impacts sections of NSF grant proposals from 105 funded and unfunded NSF proposals from ISU faculty. In Year 4, this work was completed and findings were presented to the ISU community at this workshop. Derived from the text analysis of proposals, Dr. Cotos shared tips for writing effective broader impacts statements as well as syndromes to avoid. Materials from the workshop are available on the website. Dr. Cotos was invited to present this material at a workshop hosted by the Broader Impacts Network at the University of Missouri in April 2014.

III.C.2. Spring 2014 Brown Bag Lunch Series

SP@ISU coordinated brown bag lunches during the spring 2014 semester to discuss topics related to broader impacts. These informal discussions were led by faculty and staff that are experienced in various areas of broader impacts and were open to all graduate students, postdocs, faculty and staff.

Broader Impact Activities in CAREER Proposals

February 24, 2014

Speakers:

Alex Travesset, Associate Professor, Physics and Astronomy

Mayly Sanchez, Associate Professor, Physics and Astronomy

Aditya Ramamoorthy, Associate Professor, Electrical and Computer Engineering

SP@ISU Faculty Leader Alex Traveset presented and facilitated the session on incorporating broader impacts into NSF CAREER proposals. He presented background information on NSF's BI criterion, tips for preparing the broader impacts section of a CAREER proposal and his own experience with his CAREER award. Drs. Mayly Sanchez and Aditya Ramamoorthy discussed the BI plans from their CAREER awards as well.

Data Management Planning

March 12, 2014

Speakers:

Bonnie Bowen, SP@ISU Co-PI

Megan O'Donnell, Scholarly Communications Librarian

This repeated the November 5, 2013, seminar described below.

Your Broader Impacts Questions Answered

March 25, 2014

Speakers:

Diane Rover, Professor of Electrical and Computer Engineering and
SP@ISU Director

Bonnie Bowen, SP@ISU Co-PI

Megan Heitmann, SP@ISU Assistant Director

The SP@ISU team highlighted resources available to researchers and answered questions about their BI plans.

Working in K-12 for Broader Impacts

April 9, 2014

Speakers:

Fredric Janzen, Professor of Ecology, Evolution, and Organismal Biology

Adah Leshem, Pre-College Education Programs Director, NSF Center for
Biorenewable Chemicals

SP@ISU Faculty Leader Fredric Janzen facilitated this session and gave an in-depth presentation on the summer research program he runs for high school students. Researchers were given NSF BI expectations and tips on how to write BI plans and how to partner with K-12 programs at ISU.

III.C.3. Faculty Consultations

Upon request, SP@ISU assists faculty one-on-one in person or by email or phone with their broader impacts plans. During year 4 of the project, team members consulted with ten faculty members regarding broader impacts plans for their proposals. Five of these faculty members were preparing NSF CAREER proposals.

III.C.4. Partnerships and Co-sponsored Events

SP@ISU coordinates with other NSF-funded programs on campus, such as Iowa EPSCoR, IINSPIRE-LSAMP, and NSF Engineering Research Center for Biorenewable Chemicals (CBiRC). SP@ISU also interacts with other ISU programs doing broader impacts work. SP@ISU joined with partners to offer the following sessions during year 4.

Iowa EPSCoR

SP@ISU participated in the Iowa EPSCoR Annual All-Hands Meeting in July 22 – 23, 2013, at the University of Northern Iowa and presented at the “Integrating Research and Diversity” session and the “Year 3 Planning: Broader Impacts Platform” session. SP@ISU also participated in the Iowa EPSCoR external review visit on September 6, 2013. On November 5, 2013, SP@ISU co-hosted a brown bag workshop with Iowa EPSCoR and the Office of the VP for Research on preparing data management plans; see below.

The new Iowa EPSCoR Broader Impacts Platform Leader, Dr. Sriram Sundararajan, is also an Equity Advisor. The partnership with Iowa EPSCoR provides infrastructure to disseminate best practices, strengthen mutual goals, and enhance visibility.

Data Management Brown Bag Seminar

November 5, 2013

SP@ISU, Iowa EPSCoR, the Office of the Vice President for Research, and ISU Library collaborated in 2013 to develop tools and resources to assist faculty in developing quality data management plans. From this a Library Guide was developed and a brown bag lunch seminar was held. Presenters shared information about data management plans, best practices, and expectations of funding agencies. Researchers were also informed about the ISU Library as a resource for data management plans and data sharing. The presentation was given by Bonnie Bowen, Co-PI of SP@ISU and Megan O'Donnell, Scholarly Communication Librarian.

Fourth Iowa State University Summer Symposium on Science Communication

June 5-7, 2014

During this symposium hosted by Science Communication @ ISU, SP@ISU sponsored a special plenary session titled “Advancing Broader Impacts: Theory and Practice.” Presenters discussed frameworks for including science communication as a broader impact, how it can be better utilized as a broader

impact, and national resources that may be utilized. Information and video from this session can be found at the SP@ISU website.

Presenters:

Megan Skrip, University of Rhode Island, *Assessing the Broader Impacts of Ecological Research: Towards a "Broader Impacts Impact Factor"*

Michael Dahlstrom, Iowa State University, *Doing Broader Impacts?: The National Science Foundation (NSF) Broader Impacts Criterion and Communication-Based Activities*

Melanie Roberts, AAAS, *Respondent*

III.D. Broader Impacts Infrastructure

As the SP@ISU program has built on current NSF programs to increase efficiency and effectiveness and faculty recognition for broader impacts work, we have affected the faculty support infrastructure at the university. During year 4 of the program we have taken strides to increase support and recognition for faculty broader impacts at various levels within the university and continued to improve the resources available to support faculty.

III.D.1. Taskforce for the Scholarship of Outreach and Engagement

Director Diane Rover represented SP@ISU on this taskforce. Its primary goal was to enhance the consistency of engaged scholarship across ISU faculty governance documents and evaluation processes and to more fully meet ISU's land-grant university mission by giving voice to engaged scholarship. The taskforce issued a report on May 1, 2014 to the Associate Provost for Faculty recommending that a section on engaged scholarship be added to the Faculty Handbook; consistent definitions, products, outcomes, and measurement for engaged scholarship be adopted campus-wide; and a framework be developed and used in faculty promotion and tenure. The timing of the work of the taskforce is fortuitous for SP@ISU and will help support the changes in culture and institutional practices with respect to the promotion and tenure process sought by the program.

III.D.2. Taskforce for the Review of Faculty Position Responsibility Statements

The Faculty Senate and Office of the Senior Vice President and Provost established a taskforce to review procedures in the development of faculty Position Responsibility Statements (PRSs) and their role in evaluations. As part of the information to be considered by the taskforce, several constituencies were invited to send responses/reactions to the questions and concerns that were relevant to the constituency. SP@ISU team members prepared a list of recommendations for this taskforce to consider with respect to recognizing faculty for their broader impacts work.

III.D.3. Website Resources

SP@ISU's website contains a database of programs on campus that support broader impacts and provides a compilation of literature and resources related to broader impacts.

Information is categorized according to areas of broader impacts, and for programs, contact information is provided. Improvements to the website during year 4 included search capabilities for the program database to make it easier for faculty to locate programs that match their interests. The catalog is searchable by keyword, broader impact areas, audience served by the program, and college. The SP@ISU website is accessible from the alphabetical index on ISU's homepage and as a quick link from the Office of the Vice President for Research homepage.

III.E. National Collaborations

SP@ISU team members contributed to noteworthy national activities during year 4. These efforts and new collaboration are helping to position SP@ISU as a national leader and to highlight their innovative work in this area.

III.E.1 Research Coordination Network Proposal

Collaborators from Iowa State University (SP@ISU team members), University of Missouri, Northwestern University, University of Pennsylvania, Stanford University, and University of Wisconsin met at Northwestern University in Chicago in October 2013 to prepare a proposal for an NSF Research Coordination Network. This proposal, titled "RCN: Broader Impacts and Outreach Network for Institutional Collaboration (BIONIC), was submitted on November 15, 2013. As of June 6, 2014 this proposal has been recommended for funding by NSF with a proposed start date of August 1, 2014. More information on this proposal can be found in the dissemination section.

Attendees from Iowa State:

Diane Rover, Professor of Electrical and Computer Engineering, Co-PI and
Director of SP@ISU
Megan Heitmann, Assistant Director of SP@ISU

III.E.2. Innovation through Institutional Integration (I³) Conference: "Improving the Undergraduate STEM Experience"

March 12 – 14, 2014

Members of the SP@ISU team attended this conference held at the National Academy of Sciences. The conference was designed to capture and distill best practices and lessons learned from institutions that have demonstrated the capacity to create and sustain innovative programs. The conference provided an opportunity to share innovations that have had an impact and have been sustained. It also provided opportunities to hear from other exemplary programs across the country while participants learned best practices, networked with others and explored future funding opportunities. Videos of the session are available on the conference website, <http://nsf-i3.org/conference/>.

Attendees from Iowa State:

Diane Rover, Professor of Electrical and Computer Engineering, Co-PI and
Director of SP@ISU

Mack Shelley, Professor of Statistics and Political Science, Co-PI for
SP@ISU

III.E.3. Broader Impact Infrastructure Summit: Sustainability, Return on Investment, and Community Impact

April 16-18, 2014

Members of the SP@ISU team served on the organizing committee for this summit. Team members and collaborators, presented at and participated in this summit. Diane Rover also served as a Co-PI on an EPSCoR Workshop proposal to help fund the summit. The summit goals were to increase collaboration among broader impacts professionals, enhance broader impacts scholarship, and influence policy regarding broader impacts. Presentations, posters, video and audio of the summit are being posted at the summit website, <http://www.broaderimpacts.net>.

Attendees from Iowa State:

Diane Rover, Professor of Electrical and Computer Engineering, Co-PI and
Director of SP@ISU

Mack Shelley, Professor of Statistics and Political Science, Co-PI for
SP@ISU

Megan Heitmann, Assistant Director of SP@ISU

Nancy Franz, Professor Emeritus of the School of Education

Sriram Sundararajan, Associate Professor of Mechanical Engineering, BI
Platform Leader for Iowa EPSCoR, Equity Advisor for the College of
Engineering

III.F. Planning and Evaluation

The external evaluator, internal assessment coordinator, and partnerships with campus evaluation programs assist SP@ISU in planning, implementing and evaluating program activities.

III.F.1. External Evaluator Site Visit

SP@ISU External Evaluator, Dr. Mariko Chang, visited ISU May 6-7, 2014, to conduct interviews with key stakeholders. Evaluation methods included interviews, the analysis of workshop survey data, documentation of program activities, and internal evaluation documents. Dr. Chang submitted a report on her findings to the SP@ISU team in June 2014. The SP@ISU team has reviewed the recommendations and will use them to guide year 5 planning.

III.F.2. Program Partner Survey

SP@ISU conducted a survey during summer 2013 to better understand how campus BI programs interact with faculty collaborators. SP@ISU had access to and analyzed information about faculty-faculty collaboration on NSF proposals. However, information about faculty-program collaborations was not tracked. The survey asked 31 partner

programs at ISU to list faculty with whom their program had collaborated in each of the past six years. By August 1, 2013, seventeen programs had replied. Understanding the connections between programs and faculty is expected to enhance BI-related social network analysis and measures of progress.

III.F.3. Data Analysis of NSF Grant Proposals

RISE (Research Institute for Studies in Education) updated data on NSF grant proposals from the Office of Sponsored Programs Administration to cover 2008-2012. Data include number of NSF applications, number funded, and measures of funding. These data provide a context for gauging proposal and award activity on campus and serve as potential baseline data for SP@ISU evaluation.

IV. Findings

IV.A. Feedback from Key Stakeholders

IV.A.1. Advisory Council

SP@ISU leadership met with the Advisory Council in December 2013. The council discussed and provided input about topics including: SP@ISU leadership and personnel changes, the project's fall events and meetings, SP@ISU's involvement in preparing an NSF Research Coordination Network proposal, the national impact of SP@ISU, and potential strategies for sustainability. The council recommended that SP@ISU continue to look at how we are impacting the institution and culture locally before we try to measure our impact on the national scale. They felt that the strongest case for sustaining SP@ISU activities will be by having strong evidence of our impact on ISU researchers.

IV.A.2. Executive Steering Committee

The Executive Steering Committee, chaired by the Senior Vice President and Provost, met in November 2013. During this meeting, SP@ISU leaders updated Provost Wickert on program activities and objectives. Provost Wickert provided his feedback and recommendations. Topics discussed included: project updates, college level networking and resources for faculty, interaction with Iowa EPSCoR, the emerging national broader impacts network, and program sustainability. Provost Wickert agreed that ISU has a unique opportunity to be a leader nationally on modeling institutional support for faculty doing work in broader impacts areas. He also affirmed the importance of outcomes measures associated with faculty broader impact activities to help build the case for sustainability.

IV.A.3. Faculty Leaders and Equity Advisors

Faculty Leaders and Equity Advisors were interviewed during the external evaluator visit. The following are the evaluator findings including several direct quotes from those interviewed.

Equity Advisors and Faculty Leaders (current and former) view themselves as agents of change and actively guide the development of a broader impacts culture.

“For me, what I do is broader impacts, so it’s very much in line...SP@ISU is a great resource that I can refer people to.”

“I am constantly referring people to the SP@ISU website and pointing them to resources.”

“I am always offering to help people with their proposals and giving advice. I take it as my job to help anyone who I feel can benefit.”

IV.A.4. Website Resources

Feedback from stakeholders regarding the SP@ISU website was captured in interviews by the external evaluator. The following are the evaluator findings.

The website was mentioned by many stakeholders as an important resource for faculty. Many noted improvements to the website over the past year. The focus on providing useful content, including the new search feature for partner programs, was mentioned in several interviews. Stakeholders reported referring people to the website often and the website was viewed as a critical interface between faculty and SP@ISU.

Stakeholders were unsure, however, how visible the site was for those who did not already know about it and one stakeholder thought a more aggressive link from the ISU home page would be helpful. While stakeholders felt the website was much improved, some would like to see additional refinement. For example, one interviewee explained, “The website has become much more useful and provides such good resources. It is still a bit more promotional than functional, though. There is still a lot of text and it could be even more user-friendly. And, of course, even more examples are always welcome.”

IV.A.5. Program Partner Survey Findings

Seventeen program partners replied to this survey, mentioning a total of 514 faculty collaborators. There were 408 individual collaborators; 76 faculty collaborators were mentioned by two programs, and 30 were mentioned by more than two programs. There were 267 individuals who collaborated for only one year; 194 individuals who collaborated for two to three years, and 53 individuals who collaborated for four years or more. Social Network Analysis was done on this data by the Research Institute for Studies in Education (RISE). Further review and interpretation of this study is planned.

IV.B. Workshop Series Findings

IV.B.1. Data Management Brown Bag Seminar

Thirty-one participants filled out evaluation forms for this brown bag seminar; the majority of the participants were faculty and staff. Based on the number of attendees and the responses we gained from the evaluation it is clear that data management is an area of interest on the ISU campus. The overall positive reception of the presentation indicates

that it was effective in explaining data management planning and provided useful resources for researchers. The responses show that while all parts of data management are important to ISU researchers, data sharing and preservation are considered the most difficult parts of the data management planning process. We can conclude that all parts of the presentation were considered valuable by most of the participants but that they were most interested to hear about the tools and resources they can use to write their own data management plans. The guide and checklists we developed are valuable and will need to be maintained and updated regularly for them to retain their usefulness. Any changes or additions to campus-wide resources will also need to be integrated into the guide and future presentations.

IV.B.2. Broader Impacts Text Analysis Workshop

Fifty-six people attended the workshop, the majority of which were faculty, about evenly split by rank. Most workshop participants were from the College of Engineering and College of Liberal Arts and Sciences.

Findings from evaluation forms suggest the workshop's impacts are aligned with SP@ISU goal #3, to facilitate and enhance the knowledge base needed by faculty to develop well-researched broader impacts plans as part of their research enterprise. For example, 91% of participants who completed evaluation forms agreed or strongly agreed that the workshop "has contributed to my understanding of writing a quality broader impacts section" and 94% "anticipate using this information in my next proposal."

IV.B.3. Spring 2014 Brown Bag Series

Sixty-two people attended the spring brown bag lunches. Assistant professors were drawn to the "Broader Impact Activities in CAREER Proposals" brown bag. Faculty (across all ranks) were least likely to attend the Working in K-12 Broader Impacts workshop, but graduate students and staff were drawn to this topic. Most participants at these brown bags were from the College of Engineering, but almost all colleges are represented across the brown bags. Participant feedback about the brown bags was very positive with all participants reporting they would recommend the brown bags to colleagues and students. The brown bags helped enhance the knowledge base for faculty to develop well-researched broader impacts plans as part of their research, i.e. SP@ISU goal #3, by providing information that is relevant to their research and by increasing knowledge of how to develop K-12 activities and partnerships for broader impacts.

IV.C. Evaluation Findings

IV.C.1. External Evaluator Report Findings

On June 24, 2014, the SP@ISU external evaluator submitted her report to the SP@ISU team. This report contains her findings based on both quantitative and qualitative data from interviews, event evaluation forms, program documentation, faculty grant submission data, and Social Network Analysis of collaborations between faculty and partner

programs. This report is used for reflection on year four activities and planning for year five. Below are some of the evaluator findings excerpted from this report, the entire report can be found at the SP@ISU website.

Significant **accomplishments** and **strengths** in Year 4 included:

- Enhanced program visibility
- Website improvements, including a new partner program search feature
- Continued successful programming to facilitate the development of well-researched broader impacts plans
- Project team is well-respected, knowledgeable, and has been responsive to requests, including those requiring customizing information to different audiences
- Establishing a national presence and leadership role with respect to broader impacts efforts
- Preliminary evidence suggesting SP@ISU is helping to create a “broader impacts culture” at Iowa State, especially with respect to growing awareness of the importance of broader impacts as part of a successful research enterprise

The conclusions by the external evaluator were drawn in part through interviews with stakeholders. Stakeholders reported that SP@ISU is much more visible on campus. The visits to colleges and departments, improvements to the website, and continued programming are credited by stakeholders as helping to improve visibility. Stakeholders noted the Office of the Provost and/or Office of the Vice President for Research were appropriate places for SP@ISU resources and activities to be sustained post grant-funding. Maintenance of the website content and support of a staff person (to actively connect people to resources, to answer questions, and to conduct workshops) were core SP@ISU activities stakeholders mentioned should be sustained post grant-funding.

One of SP@ISU's approaches to building a broader impacts culture has been to identify highly-connected faculty and target them for information about SP@ISU's resources and invite them to participate in events. Interview data suggest this is an appropriate strategy. However, having resources available and visible to all faculty is important as well because not all faculty have equal access to networks of helpful information. The grant's two-pronged approach of making resources widely available (through the website and workshops, for example) as well as through faculty networks is likely to be more effective than either approach alone. Long-term sustainability therefore should encompass both methods.

Stakeholders reported there is growing awareness of the importance of broader impacts at Iowa State. Many felt a cultural change was indeed taking place, but some felt the change is uneven across the university (at least at this point). Cultural change takes time, but there is evidence that SP@ISU is helping to develop and support a culture at ISU that values broader impacts. However, feedback from stakeholders suggests that cultural change with respect to the promotion and tenure process is most difficult. The timing of the work of the Task Force for the Scholarship of Engagement and Outreach is fortuitous

for SP@ISU and will help support the changes in culture and institutional practices with respect to the promotion and tenure process sought by the grant.

The main **challenges** experienced in Year 4 included:

- Changing culture specifically with respect to the value of broader impacts activities and scholarship in the tenure and promotion process
- Uneven engagement of faculty and units with respect to a culture that values broader impacts activity and scholarship

The following overall conclusions were written by the external evaluator in her report: SP@ISU has built upon its strengths. Campus-wide workshops to enhance broader impacts knowledge and the integration of broader impacts within research enterprises have been well-received by participants (based on workshop evaluation forms and interview data). Many stakeholders see evidence of cultural change at the university, especially regarding the importance of broader impacts activities as part of a successful research enterprise. Cultural change with respect to the promotion and tenure process is expectedly more difficult. Although the protocols for assessment and evaluation of faculty broader impacts activities and scholarship in the promotion and tenure process are being reinforced, many faculty do not believe these activities are as highly valued in the promotion and tenure process *yet*. Strong commitment from the administration and first-hand demonstration of that commitment will be necessary to support a cultural shift to more highly value and reward broader impacts activities and scholarship. Disciplinary norms within academia will also need to be addressed.

While SP@ISU is helping to create and support a broader impacts culture at Iowa State University, SP@ISU is also contributing to efforts to support national changes in awareness and valuing of broader impacts. The SP@ISU team has positioned itself as a leader of national broader impacts efforts through participation in the Broader Impact Infrastructure Summit and the recent I³ Conference. Moreover, aligning and advancing broader impacts efforts with other universities through their RCN grant will further disseminate findings and allow for new synergies and innovative practices to develop at a national level.

The report also state: With careful planning and diligence, SP@ISU is in a strong position to make a meaningful and sustainable impact on Iowa State University's culture and grantsmaking by strengthening faculty efforts to develop rigorous broader impacts plans as part of their research enterprise and facilitating the development of a "broader impacts culture" at Iowa State. Moreover, dissemination of activities and participation in the national dialogue on broader impacts has helped position Iowa State University as a national leader of broader impacts knowledge and strategies.

IV.C.2. External Evaluator Report Recommendations

The external evaluator report lists a number of recommendations for the program based on the evaluator findings. These recommendations will be reviewed with stakeholders and used in the planning of activities for year five. Below are some of the evaluator

recommendations excerpted from this report; the entire report can be found at the SP@ISU website.

As the grant approaches Year 5, developing a sustainability plan for key program activities is a priority. In order to inform sustainability decisions, additional assessment is needed to address the impact of the program activities on faculty knowledge of broader impacts and their ability to apply this knowledge in their teaching, outreach, scholarship, and research. Once the team has a better understanding of which activities are most impactful, they can work with other key stakeholders to determine an appropriate and effective plan for sustainability.

The team should discuss the best strategy for assessing impact and a realistic timeline for that assessment so that findings can be used to guide sustainability discussions. The team should work with the external evaluator to vet approaches to best assess impacts. A thorough review and discussion of whether additional analyses of the data on faculty grant proposals (the “gold sheet” data), Social Network Analyses, and/or other data sources (for example, an online survey) should be conducted as soon as possible. If the team decides to utilize an online survey, they should work this summer to develop survey questions and apply for IRB approval. The new internal evaluator, Dr. Lian Niu, should be engaged to support and assist with survey development, the IRB process, and survey administration.

SP@ISU activities align with both the Office of the Provost and the Office of the Vice President for Research. With a rigorous assessment of impacts, the SP@ISU team will be better able to engage in discussions of sustainability with one or both of these offices, as appropriate. The Advisory Council is well-positioned to assist with sustainability efforts and should be utilized in this manner. Opportunities for collaboration may also exist with Iowa EPSCoR’s Broader Impacts Platform and should be explored.

IV.C.3. Broader Impacts Text (BIT) Analysis Findings

The BIT Analysis project was aimed at developing materials to assist faculty writing BI components of proposals. For this purpose, BI sections in NSF grant proposals were analyzed using linguistic techniques. The analysis revealed a rhetorical structure of three major communicative goals that are achieved with sixteen strategies. The framework was then validated through manual annotation of 112 BI texts. Further, qualitative analysis of the annotated texts was used to comprehensively define the functional meaning of the discourse units employed in BI writing, describe their content and linguistic realizations, and identify surface level writing problems that affect the effectiveness of BI claims. In addition, comparative quantitative analysis of annotated BIs from successful and unsuccessful proposals revealed issues related to strategy use that need to be addressed in training. Findings from this project were disseminated through workshops at ISU and the University of Missouri.

V. Training and Professional Development

Faculty, postdoctoral scholars, graduate students, and staff have been involved in activities (e.g., Broader Impacts Text Analysis Workshop; Brown Bag Lunch Series; Iowa EPSCoR BI Platform meetings; New Faculty Orientation; Data Management Plan seminars; small group and individual consultations) that enhance their knowledge of broader impacts, writing techniques, and resources that are available on campus. The bottom up-top down approach (e.g., multiple meetings with department chairs, college associate deans for research, college grant coordinators, Faculty Leaders, and faculty) that has been used to create awareness of broader impacts has resulted in networking and information sharing campus-wide. In addition, this approach has initiated institutional integration across grants and encouraged partnering of non-STEM and STEM faculty on proposals.

Institutional infrastructure for broader impacts has emerged as a national issue relevant to educators, researchers, and university administrators across the country. After participating in the first Broader Impacts Infrastructure Summit in April 2013, SP@ISU team members worked collaboratively with a small group of institutions to submit the NSF RCN BIONIC proposal in November 2013 and organize the second summit held in April 2014. Through these efforts, all involved expanded their understanding of BI infrastructure and national BI needs. These activities were especially instructive for SP@ISU assistant director Megan Heitmann, providing her with valuable professional development in proposal writing and conference planning. Participating in the second summit, SP@ISU team members and collaborators provided and received training on infrastructure support. In addition to Heitmann and SP@ISU director Diane Rover, others from ISU who provided and received training at this summit include: Mack Shelley, SP@ISU team member; Nancy Franz, SP@ISU collaborator; and Sriram Sundararajan, EPSCoR BI Platform Leader and College of Engineering Equity Advisor. As this community moves forward there will be more opportunities for SP@ISU team members to both receive training and hold training sessions with colleagues.

VI. Dissemination to Communities of Interest

The SP@ISU project expanded dissemination of resources and results to new communities during year 4. One venue for this was the second summit on BI infrastructure in April 2014, which attracted a wider audience than the first and was video-recorded. SP@ISU co-sponsored and participated in the summit. The second summit was partially

funded through an NSF EPSCoR Workshop grant (#IIA-1437105) endorsed by the Iowa and Missouri EPSCoR projects. Thus, there was increased participation by representatives from EPSCoR jurisdictions as compared to the first summit. Of the registered participants, 29 were from EPSCoR jurisdictions, including several EPSCoR state offices.

The second summit also connected the BI community with the engagement community. Dr. Nancy Cantor, chancellor of Rutgers University-Newark, and Dr. Freeman Hrabowski, president of the University of Maryland-Baltimore County, opened the summit with a call to community engagement through broader impacts. In particular, Dr. Cantor's work has demonstrated the impact and importance of engaged scholarship; she is recognized nationally and internationally as an advocate for emphasizing the public mission and promoting a view of the university as an anchor institution that collaborates with partners from all sectors of the economy. The affinity between BI and community engagement was also the subject of the presentation by Dr. Nancy Franz, SP@ISU collaborator, in the session on training and motivating scientists. This linkage is especially important as engaged scholarship may be a promising basis to recognize faculty accomplishments in BI.

Through Iowa EPSCoR collaboration and various activities described above, SP@ISU also increased dissemination of information and practices with other Iowa public state universities.

Through SP@ISU networking, SP@ISU collaborator Dr. Elena Cotos was invited by the University of Missouri to visit campus and present her broader impacts text analysis findings in April 2014. Dr. Cotos led a workshop and also a small brown bag lunch discussion during her visit.

SP@ISU continued to engage with the science communication community through past SP@ISU Faculty Leader Dr. Jean Goodwin and current SP@ISU Advisory Council member Dr. Michael Dahlstrom. In June 2014, SP@ISU sponsored a special session on "Advancing Broader Impacts: Theory and Practice" in Iowa State's summer symposium on science communication. SP@ISU also met with one of the speakers, Dr. Melanie Roberts, former AAAS/NSF fellow and founder and director of the Emerging Leaders in Science and Society (ELISS). There is the potential for future interactions with this policy community.

Through participation in the I³ Conference at the National Academy of Sciences in Washington, DC, in March 2014, SP@ISU work was disseminated to other NSF I³ program grantees from across the country with a special focus on undergraduate STEM education.

In addition, SP@ISU is promoting networking nationally among and within communities through BIONIC, the proposed NSF research coordination network described above. SP@ISU team members collaborated on proposal development. The goal of BIONIC is to create a community of practice that fosters the development of sustainable and scalable

institutional capacity and engagement in BI activity. This goal will be accomplished through four objectives: 1) Identify and curate promising models, practices, and evaluation methods for the BI community; 2) Expand engagement in and support the development of high-quality BI activities by educating current and future faculty and researchers on effective BI practices; 3) Develop the human resources necessary for sustained growth and increased diversity of the BI community; and 4) Promote cross-institutional collaboration on and dissemination of BI programs, practices, models, materials, and resources. As of June 6, 2014 this proposal was recommended for funding by NSF with a proposed start date of August 1, 2014.

At Iowa State, SP@ISU has shared information and consulted with researchers across all disciplines. Meetings with the College of Design expanded the disciplinary breadth. Also, although the focus of SP@ISU is on NSF's broader impacts criterion and integration across NSF programs, the information shared and resources developed are proving to be relevant to a spectrum of researchers. Researchers whose primary funding is from other federal and state agencies that also must demonstrate public/societal benefit and accountability, such as the USDA or Iowa DOT, are participating in SP@ISU activities.

VII. Plans for Year 5

SP@ISU is on track to accomplish all project goals that are in line with the logic model and the external evaluator recommendations. A sustainable broader impacts culture at Iowa State will continue to be developed through internal and external networks. The internal campus-wide (STEM and non-STEM collaborations) network uses a bottom up (faculty, postdoctoral scholars, graduate student, and staff driven) and top down (university provost, vice presidents, deans, associate deans, and department chairs) approach to develop a shared understanding and commitment to broader impacts. The national external network is driven by leading universities interested in developing a broader impacts infrastructure community. SP@ISU will continue to facilitate BI networking on campus, improve documentation and communication of BI activities, promote BI evaluation, and measure success in achieving SP@ISU goals. In addition, SP@ISU will participate nationally and provide leadership to the broader impacts infrastructure community.

The following are specific recommendations set forth by the external evaluator. These recommendations will be highly considered when planning for year 5 of the project.

As the grant moves in to Year 5, the **priorities** will be to (a) develop a plan for rigorously evaluating the impact of program initiatives to inform the discussion of sustainability; and (b) work with stakeholders to establish a plan for sustainability.

The following **recommendations** will be considered to support these efforts:

- Discuss a strategy for assessing impact and a realistic timeline for that

assessment so findings can be used to guide sustainability discussions

- Work with the external evaluator to discuss approaches to best assess impacts
- Review whether additional analyses of data on faculty grant proposals, social network analysis, and/or other data sources (for example, an online survey) should be pursued
- A plan for assessment should be developed over the summer to ensure data collection and analysis can take place during Fall 2014
- Continue to seek opportunities for collaboration and synergy with key stakeholders, such as Iowa EPSCoR's Broader Impacts Platform and the Task Force for the Scholarship of Engagement and Outreach
- Utilize the commitment and expertise of the Advisory Council to establish a model for sustaining key program activities and enlist their support for sustainability efforts

VIII. Products

VIII.A. Conference Papers and Presentations

Megan Heitmann, Diane Rover (2014). *Panel Discussion - The Future of the BI Infrastructure Community*. 2014 Broader Impacts Infrastructure Summit. Arlington, VA.

Diane Rover and Mack Shelley (2014). *Strengthening the Professoriate through Broader Impacts Infrastructure poster*. Innovation through Institutional Integration Conference: "Improving the Undergraduate STEM Experience". National Academy of Sciences, Washington, D.C.

Megan Heitmann, Diane Rover, Mack Shelley (2014). *Strengthening the Professoriate through Broader Impacts Infrastructure poster*. 2014 Broader Impacts Infrastructure Summit. Arlington, VA.

Mack Shelley (2014). *Workshop - BI Measurement: What, how, and why?* 2014 Broader Impacts Infrastructure Summit. Arlington, VA.

Nancy Franz (2014). *Work shop - BI Practice: How to Train and Motivate Scientists*. 2014 Broader Impacts Infrastructure Summit. Arlington, VA.

VIII. B. Other Products

Databases

SP@ISU developed a database of programs on campus and in central Iowa that work in areas of broader impacts. Descriptions of the programs, ways faculty can partner with them, and contact information are provided. This database is available at the SP@ISU website and is searchable by keyword, broader impact area, audience served by the program, and college they are affiliated with. www.spisu.iastate.edu/programs

Audio or Video Products

SP@ISU captures video and/or audio of the events that we host. This is then uploaded to each event web page, along with any presentation materials, at the SP@ISU website. After this information is uploaded, all those who registered for the event are contacted. These video and audio files are also highlighted in future newsletters.

Events that were captured during year 4 of the project include: Spring 2014 Brown Bag Lunch series sessions (Broader Impact Activities in CAREER Proposals, Data Management Planning, and Working in K-12 for Broader Impacts) and the Fourth Iowa State University Summer Symposium on Science Communication "Advancing Broader Impacts: Theory and Practice" session.

External Evaluation Report

Mariko Chang, SP@ISU External Evaluator, produced a report based on her evaluation of the program. The report covers the period of July 2013 through May 2014 and incorporates both quantitative and qualitative data from interviews, event evaluation forms, program documentation, faculty grant submission data, and Social Network Analysis of collaborations between faculty and partner programs.

SP@ISU Newsletter

The SP@ISU newsletter shares program and broader impacts related information with program participants and the university community. Newsletters highlight BI stories, resources, events, partnerships and opportunities. During year 4 of the project newsletters were distributed September 2013, December 2013, March 2014, and May 2014.

VIII.C. Technologies or Techniques

A Broader Impacts Text (BIT) Analysis project used linguistic techniques to analyze the broader impacts sections of funded and unfunded NSF proposals. The BIT Analysis project was aimed at developing materials to assist faculty writing BI components of proposals. For this purpose, BI sections in NSF grant proposals were analyzed using linguistic techniques. The analysis revealed a rhetorical structure of three major communicative goals that are achieved with sixteen strategies. The framework was then

validated through manual annotation of 112 BI texts. Further, qualitative analysis of the annotated texts was used to comprehensively define the functional meaning of the discourse units employed in BI writing, describe their content and linguistic realizations, and identify surface level writing problems that affect the effectiveness of BI claims. In addition, comparative quantitative analysis of annotated BIs from successful and unsuccessful proposals revealed issues related to strategy use that need to be addressed in training.

VIII.D. Websites

Strengthening the Professoriate at Iowa State University

<http://www.spisu.iastate.edu>

SP@ISU's website is hosted using open source software. The server is RedHat Enterprise Linux with apache and PHP using a MySQL database (commonly called a LAMP stack). The website uses Drupal, an open source content management system.

The website also contains databases of programs on campus that work with broader impacts initiatives, and literature and resources related to broader impacts. These databases are custom Drupal node types; categories are created using the Drupal core taxonomy module. Information in these databases are searchable by keyword, area of broader impacts, and audience. The search functionality is using a contributed module (Search API) which provides a generic API for search modules. The specific search implementation used here uses the database tables for indexing content.

The website also contains video, audio, and/or presentation materials from past SP@ISU events. The video files are uploaded to YouTube and embedded onto event webpages.

e-Library, Data Management: The who, what, where, and how of data management at ISU

<http://instr.iastate.libguides.com/dmp>

This website is the ISU Guide to Data Management Planning. It covers the following areas: best practices for data management, advice for completing a Data Management Plan, resources for data management and storage for affiliates of ISU, checklists to aid in writing and implementing data management plans, boilerplate language for ISU tools and resources, and answers to frequently asked questions about data management.

This guide is the result of a collaboration between the Iowa State University Library, SP@ISU, and the Office of the Vice President for Research at Iowa State University.

IX. Impacts

IX.A. Impact on STEM Disciplines

SP@ISU has provided networking opportunities for NSF-funded programs and researchers via workshops, the development of a website and newsletter, and through planned activities and events. This has contributed to greater participation by STEM faculty, postdoctoral scholars, and graduate students in current ISU programs and in collaborations with BI partners as they develop broader impact projects related to their research activities. These stakeholders have reported that visits to STEM colleges and departments, improvements to the website, and continued programming have helped improve the visibility of SP@ISU on campus.

SP@ISU's interactions with large NSF funded centers, such as Iowa EPSCoR and the NSF ERC Center for Biorenewable Chemicals (CBIRC) led by Iowa State, helps center participants address the societal benefit of their STEM research through broader impacts. Through Iowa EPSCoR, this potentially impacts STEM research across the state of Iowa.

In addition, SP@ISU is sharing knowledge, strategies, and resources with the national BI community, including both STEM and other disciplines that partner with STEM on BI.

IX.B. Impact on Other Disciplines

SP@ISU-sponsored activities, events, and resource materials are available to the university-wide community. Faculty, postdoctoral scholars and graduate students beyond the STEM disciplines (e.g. Anthropology Business, Design, Education, English, Human Sciences, Music and Theater, Psychology, and World Languages and Cultures) have participated in activities and events and used resources provided by SP@ISU. In particular, several meetings during year 4 with College of Design faculty expanded the disciplinary reach of SP@ISU.

SP@ISU's BI partner program collaborators, most in disciplines outside of STEM, or in STEM education or discipline-based educational research, have reported that their connections with STEM faculty have improved, as have connections with other BI-related programs. They believe this is due in part to increased visibility and involvement with SP@ISU.

The computational linguistics techniques applied by Dr. Elena Cotos with SP@ISU project support to analyze the content of BI sections of NSF grant proposals are a contribution to that field. The results may also benefit the grant-writing community.

SP@ISU sponsored the session on “Advancing Broader Impacts: Theory and Practice” in Iowa State’s Symposium on Science Communication.

SP@ISU team member Dr. Mack Shelley continues to share his expertise on BI evaluation techniques. During year 4, he presented at the Broader Impacts Infrastructure Summit.

IX.C. Impact on Human Resources Development

Faculty development is an emphasis of SP@ISU. Workshops, seminars, consultations, and other informal training are advancing the knowledge, skills and abilities of faculty, postdoctoral scholars, and graduate students. Brochures, newsletters, and the website are providing information about available resources, programs and expertise.

Researchers develop a better understanding of the NSF BI criterion and how to apply it to research proposals. They also have better access to potential collaborators who can help them design, implement, and evaluate their BI activities. Increased understanding and access to BI collaborators are expected to lead to more effective BI activities and stronger engagement by researchers in BI.

Evaluation from year 4 indicates that SP@ISU’s on-campus workshop and brown bag impacts are aligned with SP@ISU goal #3, to facilitate and enhance the knowledge base needed by faculty to develop well-researched broader impacts plans as part of their research. The value of specific examples for faculty is a theme that has been echoed across all three external evaluations that have been conducted for the program and across different types of activities undertaken by SP@ISU. A best practice that SP@ISU can disseminate is the importance of providing examples for faculty.

A group of administrators and faculty participates in the SP@ISU Advisory Council to inform and advise the project. The council assists with promoting program activities and faculty awareness and participation.

Equity Advisors in ISU STEM colleges and Faculty Leaders establish relationships with faculty from across campus and assist faculty with best practices associated with the development and implementation of broader impacts. EAs and FLs are change agents who guide the development of a broader impacts culture at ISU.

In general, one of SP@ISU’s approaches to building a broader impacts culture has been to identify highly-connected faculty and target them for information about SP@ISU’s resources and invite them to participate in events. Interview data from year 4 indicate this is an effective strategy, as colleagues are likely to share information and resources with each other.

SP@ISU goal #4 is to develop protocols for assessment and evaluation of a faculty member’s BI activities for inclusion in the promotion and tenure process. Toward that end, SP@ISU contributed to the work of the Task Force on the Scholarship of Engagement

and Outreach, conducted during 2013-14 and initiated through the Provost's Office. The task force issued a report recommending a section on engaged scholarship be added to the Faculty Handbook; that consistent definitions, products, outcomes, and measurement for engaged scholarship be adopted campus-wide; and that a framework be developed and used in faculty promotion and tenure. Recommendations by the task force will help support the changes in culture and institutional practices with respect to the promotion and tenure process sought by the grant.

IX.D. Impact on Institutional Resources that Form Infrastructure

Preliminary evidence indicates that SP@ISU is influencing the institutional culture related to broader impacts at Iowa State, especially with respect to growing awareness of the importance of broader impacts as part of a successful research enterprise. The SP@ISU project is positioned to make a meaningful and sustainable impact on grantsmaking by strengthening faculty efforts to develop rigorous broader impacts plans as part of their research and facilitating the development of a BI culture. Also, the collaboration with Iowa EPSCoR potentially provides additional infrastructure to disseminate best practices, strengthen mutual goals, and enhance visibility.

Institutional infrastructure for broader impacts has emerged as a national issue relevant to educators, researchers, and university administrators across the country. In 2010, the U.S. Congress passed the America COMPETES Reauthorization Act (ACRA) that, among other things, refunded NSF and mandated BI as part of the review criteria. Section 526 of ACRA contains the following key language with respect to BI: *encourages institutions of higher education and other nonprofit education or research organizations to develop and provide, either as individual institutions or in partnerships thereof, appropriate training and programs to assist Foundation-funded principal investigators at their institutions in achieving the goals of the Broader Impacts Review Criterion as described in subsection (a); and requires principal investigators applying for Foundation research grants to provide evidence of institutional support for the portion of the investigator's proposal designed to satisfy the Broader Impacts Review Criterion, including evidence of relevant training, programs, and other institutional resources available to the investigator from either their home institution or organization or another institution or organization with relevant expertise.* This language placed formal responsibility for supporting BI activities on the institution and not just the investigator.

Iowa State and other institutions participated in the first Broader Impacts Infrastructure Summit in April 2013 led by the University of Missouri. Following that, SP@ISU team members worked collaboratively with a small group of institutions to submit the NSF RCN BIONIC proposal in November 2013 and organize the second summit held in April 2014. Through these activities, SP@ISU has both served as a model for other institutions and been shaped by others.

The following elements of SP@ISU are examples of broader impacts infrastructure support.

- SP@ISU activities align with both the Office of the Provost and the Office of the Vice President for Research. Stakeholders have indicated that (one or both of) these central upper administration offices are appropriate places for SP@ISU resources and activities to be sustained post grant-funding.
- The grant's two-pronged approach of making resources widely available (through the website and workshops, for example) as well as through faculty networks is likely to be more effective than either approach alone. Long-term sustainability should encompass both methods.
- The website, program database, and staff person – to actively connect people to resources, to answer questions, and to conduct workshops – have been cited by stakeholders as core SP@ISU functions.
- The Advisory Council represents colleges and interests across campus.
- SP@ISU provides support that may help to engage faculty.
- SP@ISU provides support that is available to all faculty and may supplement varying levels of individualized grant support across colleges and departments.

IX.E. Impact on Information Resources that Form Infrastructure

The SP@ISU website is an important resource for faculty. The website contains a database of campus programs and broader impacts resources. These help faculty develop their broader impacts ideas and identify potential areas and individuals for collaboration. During the past year, SP@ISU improved the database search capabilities for partner programs to make it easier for faculty to locate programs that match their interests. The catalog is searchable by keyword, broader impacts area, audience served by the program, and college. The website also provides presentation materials from past SP@ISU events, video and audio of presentations if available, and a compilation of various information, literature and resources related to broader impacts. Resources such as brochures are available in print and electronic formats. A newsletter, distributed by email several times a semester and posted to the website, provides resources, events, and opportunities for faculty to become and stay engaged.

SP@ISU co-sponsored two brown bag lunch sessions on developing data management plans for proposals. These sessions informed faculty about NSF and other agency requirements as well as the resources Iowa State has to offer. Preparation for these sessions led to the creation of an online library guide: Data Management: The who, what, where, and how of data management at ISU, <http://instr.iastate.libguides.com/dmp>. This website covers best practices for data management, advice for completing a data management plan, resources for data management and storage for affiliates of ISU, checklists to aid in writing and implementing data management plans, boilerplate language for ISU tools and resources, and answers to frequently asked questions about data management. This guide is the result of a collaboration between the Iowa State

University Library, SP@ISU, and the Office of the Vice President for Research. While this guide has information specific to ISU, it is generally useful to anyone writing a data management plan, and thus is a resource for the DMP community. Ultimately, this resource is expected to improve the quality of research data management and thus longer-term information infrastructure.

IX.F. Impact on Society beyond Science and Technology

SP@ISU is helping implement federal and NSF policies mandated through the America Competes Reauthorization Act. It is helping create and support broader impacts infrastructure at Iowa State University, facilitating BI understanding and partnering in the state of Iowa, and contributing to efforts to support national changes in awareness and valuing of broader impacts. The SP@ISU team has positioned itself as a leader of national broader impacts efforts through participation in the Broader Impact Infrastructure Summit and the I³ Conference. Moreover, aligning and advancing broader impacts efforts with other universities through the pending RCN grant will further disseminate findings and allow for new synergies and innovative practices to develop at a national level. These efforts are expected to enhance institutional capabilities to establish and sustain a broader impacts culture that will impact society beyond science and technology.