User-Friendly Ideas for Project Evaluation

SP@ISU Broader Impacts Evaluation Workshop
November 28, 2012

Mack Shelley
University Professor
Departments of Statistics and Political Science

Mari Kemis
Assistant Director
Research Institute for Studies in Education (RISE)
Today’s Objective

• The objective for today is to
  – focus on key aspects of what NSF expects to see in a project proposal
  – how to evaluate broader impacts
  – help with your grant writing
  – evaluate already-funded projects
Why Does This Matter?

• All NSF proposals are required to provide very specific information about two official merit-review criteria of the proposed effort:
  – Intellectual Merit
  – Broader Impacts
• Let’s take a closer look at what these criteria really require.
  – We’ll focus today on broader impacts, but keep in mind that the intellectual merit must be articulated clearly and strongly, too, and that your broader impacts components of the proposal should be aligned with the intellectual merit components.
Intellectual Merit

• Advance knowledge and understanding
• Qualified PI
• Explore creative, original or potentially transformative concepts
• Well organized and conceived proposal
• Sufficient access to resources
Broader Impacts

• How well does the activity advance discovery and understanding while promoting teaching, training, and learning?
• How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)?
• To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships?
• Will the results be disseminated broadly to enhance scientific and technological understanding?
• What may be the benefits of the proposed activity to society?
Which Means What, Exactly?

• Your one-page **Project Summary** “must specifically address the project's intellectual merit and broader impacts. If the Summary does not specifically address both review criteria in separate statements, the proposal will be returned without review.”

• “The **Data Management Plan** will be reviewed as part of the intellectual merit or broader impacts of the proposal, or both, as appropriate.”

• “**Mentoring** activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary document, will be evaluated under the Broader Impacts criterion.”
Broader Impact Themes and Categories

- Work Force Development: REU, Undergraduate, Post-doc, Peer Mentoring, Course Integration
- Society: Policy/ Management, Societal Impact, Environment
- Public Dissemination: Public Accessibility, Public Outreach, COSEE, Informal Science Education
- K12 Education: K12 Casual Talks, K12 Curricula, K12 Formal Activities, K12 Student Mentoring, K12 Teachers, RET, GK12
- Instrumentation and Facilities: Includes Technological Innovation, Infrastructure
- Multi-user Facilities, CREST
- Collaboration: Includes Interdisciplinary, Industrial, and International Collaborations
- NSF Sponsored Programs: AGEP, CREST, DLESE, GK12, IGERT, LSAMP, OEDG, RET, REU
- Underrepresented Minorities: OEDG, LSAMP, CREST, AGEP, Outreach to Underrepresented Minorities, and Underrepresented Minorities
Promote Teaching, Training and Learning

• Engaging with the broadest possible spectrum of the K-12 community
  – K-12 Teachers
  – K-12 Students
  – K-12 Administrators
  – K-12 Guidance Counselors
Think about Broader Impacts through the Lens of Intellectual Merit Metrics

- Advance knowledge and understanding
- A qualified PI
- Explore creative, original or potentially transformative concepts
- A well organized and conceived proposal
- Sufficient access to resources
Advance Knowledge and Understanding

- What are stumbling blocks for student success/engagement in STEM fields?
- What ethnic/gender groups are underrepresented in target science field?
- Teachers and students
- What resources are traditionally unavailable in the K12 environment that can realistically enhance students learning?
- What are common fundamental conceptual gaps?

The review panel will look closely to make sure the PI has identified these points.
PI Qualifications

• Teaching experience
• Understanding of standards/testing requirements
• Familiarity with K-12 environment
• Experience mentoring

The review panel will need to be convinced that the PI has identified his/her qualifications that are relevant to the success of the proposal.
Explore creative, original or potentially transformative concepts

• Partner with existing successful programs (RETs for In-service educators/REUs for pre-service educators)

• Reach out to the Educational Research Community within the home institution

• Leverage existing NSF investments in education

*It is important to note that the PI does not need to “reinvent the wheel” for the sake of Broader Impacts*
Well Organized and Conceived

- Broader Impacts flow from the PI’s science proposal
- Demographics are considered
- Educational arena addressed
- Standards researched and linked to the BI
- Specific teachers and administration of participating schools are identified and have submitted letters of commitment
- Links made to existing programs/broader impacts
- Engagement of teachers in the development process

Can the review panel find clear evidence of these efforts?
Sufficient Access to Resources

• Evidence of connection with individuals/target community
• Evidence of affiliation with established programs
• Articulated plan for making resources available (funding, transportation, scheduling)
• Clear plan detailed for the logistics of sending teachers to professional conferences to share their work with the PI

The review panel will check carefully to make sure that these resource issues have been addressed satisfactorily.
Stick with “Best Practices”

**Teacher Programs**
- Multiple days, summer opportunities
- $$ compensation/grad credit
- Follow up meetings
- Built-in opportunities and time for teacher collaboration
- Host a teacher cohort
- Focus on lab technique & process
- Relevant content
- STEM career mapping
- Involve pre-service teachers
- Include teachers in the workshop design process

**Student Programs**
- PI classroom visits with attention to grade level, covering reasonable content and level of detail/sophistication
- Provide hands-on experiences
- Go with classes on field trips
- Contextualize the PI’s science research in society
- Give meaningful and relevant presentations
- Career mapping
- Try to relay excitement about science
- Share new/emerging careers
Yeah, but What do Broader Impacts Look Like in Practice?

• Examples of activities to demonstrate broader impacts are available at: http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf
• These are among the specifics that are looked for by reviewers and by NSF program staff in their funding decisions.
• This information is not exhaustive, and not all examples need to be present in any given proposal.
• Proposal authors should be creative in demonstrating the broader impacts of their projects.
• Try to link similar kinds of activities you already may have underway to the research and education projects you are proposing for funding.
• Proposers also should consider what types of activities best suit their interests, while enhancing the broader impacts of the project being proposed.
Examples of Activities to Advance Discovery and Understanding While Promoting Teaching, Training, and Learning

- Integrate research activities into the teaching of science, math, and engineering at all educational levels (e.g., K-12, undergraduate science majors, non-science majors, and graduate students).
- Include students (e.g., K-12, undergraduate science majors, non-science majors, and/or graduate students) as participants in the proposed activities as appropriate.
- Participate in the recruitment, training, and/or professional development of K-12 science and math teachers.
- Develop research-based educational materials or contribute to databases useful in teaching (e.g., K-16 digital library).
- Partner with researchers and educators to develop effective means of incorporating research into learning and education.
- Encourage student participation at meetings and activities of professional societies.
- Establish special mentoring programs for high school students, undergraduates, graduate students, and technicians conducting research.
- Involve graduate and post-doctoral researchers in undergraduate teaching activities.
- Develop, adopt, adapt, or disseminate effective models and pedagogic approaches to science, mathematics, and engineering teaching.
Examples of Activities to Broaden Participation of Underrepresented Groups

- Establish research and education collaborations with students and/or faculty who are members of underrepresented groups.
- Include students from underrepresented groups as participants in the proposed research and education activities.
- Establish research and education collaborations with students and faculty from non-Ph.D.-granting institutions and those serving underrepresented groups.
- Make campus visits and presentations at institutions that serve underrepresented groups.
- Establish research and education collaborations with faculty and students at community colleges, colleges for women, undergraduate institutions, and EPSCoR (http://www.nsf.gov/od/oia/programs/epscor/about.jsp) institutions.
- Mentor early-career scientists and engineers from underrepresented groups who are submitting NSF proposals.
- Participate in developing new approaches (e.g., use of information technology and connectivity) to engage underserved individuals, groups, and communities in science and engineering.
- Participate in conferences, workshops and field activities where diversity is a priority.
Examples of Activities to Enhance Infrastructure for Research and Education

• Identify and establish collaborations between disciplines and institutions, among the U.S. academic institutions, industry, and government and with international partners.

• Stimulate and support the development and dissemination of next-generation instrumentation, multi-user facilities, and other shared research and education platforms.

• Maintain, operate, and modernize shared research and education infrastructure, including facilities and science and technology centers and engineering research centers.

• Upgrade the computation and computing infrastructure, including advanced computing resources and new types of information tools (e.g., large databases, networks, and digital libraries).

• Develop activities that ensure multi-user facilities are sites of research and mentoring for large numbers of science and engineering students.
Examples of Activities for Broad Dissemination to Enhance Scientific and Technological Understanding

• Partner with museums, nature centers, science centers, and similar institutions to develop exhibits in science, math, and engineering.
• Involve the public or industry, where possible, in research and education activities.
• Give science and engineering presentations to the broader community (e.g., at museums and libraries, on radio shows, and in other such venues).
• Make data available in a timely manner by means of databases, digital libraries, or other venues such as CD-ROMs.
• Publish in diverse media (e.g., non-technical literature, and websites, CD-ROMs, press kits) to reach broad audiences.
• Present research and education results in formats useful to policy-makers, members of Congress, industry, and broad audiences.
• Participate in multi- and interdisciplinary conferences, workshops, and research activities.
Examples of Activities to Demonstrate Benefits to Society

• Demonstrate the linkage between discovery and societal benefit by providing specific examples and explanations regarding the potential application of research and education results.

• Partner with academic scientists, staff at federal agencies and with the private sector on both technological and scientific projects to integrate research into broader programs and activities of national interest.

• Analyze, interpret, and synthesize research and education results in formats understandable and useful for non-scientists.

• Provide information for policy formulation by Federal, State, or local agencies.

Percent of abstracts with BI statements

<table>
<thead>
<tr>
<th>Year</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>0.0</td>
</tr>
<tr>
<td>1986</td>
<td>2.9</td>
</tr>
<tr>
<td>1987</td>
<td>4.4</td>
</tr>
<tr>
<td>1988</td>
<td>13.5</td>
</tr>
<tr>
<td>1989</td>
<td>31.0</td>
</tr>
<tr>
<td>1990</td>
<td>33.3</td>
</tr>
<tr>
<td>1991</td>
<td>42.8</td>
</tr>
<tr>
<td>1992</td>
<td>26.3</td>
</tr>
<tr>
<td>1993</td>
<td>46.4</td>
</tr>
<tr>
<td>1994</td>
<td>66.7</td>
</tr>
<tr>
<td>1995</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
</tr>
<tr>
<td>1997</td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td></td>
</tr>
<tr>
<td>1999</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
</tr>
<tr>
<td>2002</td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td></td>
</tr>
</tbody>
</table>
Recent Articles About BI


What’s New at NSF?

Grant Proposal Guide (NSF 13-1, effective January 14, 2013)
Changes in Merit Review

• The project must be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.

• NSF projects … should contribute broadly to achieving societal goals. Broader impacts can be the result of the research, itself; research-related activities; or activities that are supported by and complementary to the research project.

• Outcomes related to both major review criteria should be assessed/evaluated at either the individual- or aggregate-project level.
So, What Else is New?

• BI evaluation is not strictly focused on the evaluation done by a PI (or by the evaluator working with the PI team) to judge the success of the BI activities.
  – While that is essential, equally important is the need for the PI to use relevant research, evaluation results, and resources in developing the plan for the BI activities, where appropriate improving on prior results, and writing about the results.

• This is a handy webpage on the revised NSF review criteria:
  http://www.nsf.gov/bfa/dias/policy/merit_review/resources.jsp

• One of the unknowns is how the revisions will be implemented over time and the extent to which they will be enforced in the review process.
Anything Else?

Changes to the Proposal Process

• The Project Summary will contain the following required separate statements
  - Overview of the Project
  - Statement on Intellectual Merit
  - Statement on Broader Impacts

• The Project Description must contain a separate section with a discussion of the Broader Impacts

• Proposing organizations must certify that organizational support will be made available, as described in the proposal to address the Broader Impacts and Intellectual Merit activities.

• Annual and Final Reports must address activities related to the Broader Impacts criterion that are not intrinsic to the research.
NSF Resources for Grant Preparation

GPG—Chapter 2—Proposal Preparation Instructions
• http://www.nsf.gov/pubs/policydocs/pappguide/nsf11001/gpg_2.jsp#IIC2j

GPG—Chapter 3—NSF Proposal Processing and Review
• http://www.nsf.gov/pubs/policydocs/papp/gpg_3.jsp

• www.nsf.gov/eng/iip/sbir/Sample Postdoc Mentoring Plan.doc

• http://dataservices.gmu.edu/data-management/nsf-dmp-template/
The User-Friendly Handbook

• Developed to provide NSF project directors and principal investigators working with a basic guide for evaluating NSF’s educational projects.

• Aimed at people who need to learn more about both the value of evaluation and how to design and carry out an evaluation
  – rather than those who already have a solid base of experience in the field

• Blends technical knowledge and common sense to meet the special needs of NSF and its stakeholders.

The User-Friendly Handbook

Why should NSF grantees conduct evaluations?

- Evaluation produces information that can be used to make continuous improvements in the project.
- An evaluation can document what has been achieved.
  - extent to which goals are reached and desired impacts are attained
- Evaluation frequently provides new insights or new unanticipated information.
- There is an inherent interrelationship between evaluation (formative and summative) and program implementation.
- Provides information for communicating to stakeholders about the worth of the project to the public and “up the line” to senior decisionmakers and funders.
  - Government Performance and Results Act (GPRA)
  - the Office of Management and Budget’s Program Assessment Rating Tool (PART)
  - NSF assessment and reporting requirements
The User-Friendly Handbook

• Different Types of Evaluation
  – Formative evaluation
  – Implementation evaluation
  – Progress evaluation
  – Summative evaluation
The User-Friendly Handbook

• Six phases of project evaluation
  – Develop a conceptual model (focused on the broader impacts) of the program and identify key evaluation points
    • Logic model
  – Develop evaluation questions and define measurable outcomes
  – Develop an evaluation design
  – Collect data
  – Analyze data
  – Provide information to interested audiences (i.e., tell your story)
The User-Friendly Handbook

- How should I go about getting evaluation data?
  - Surveys
  - Interviews
  - Social network analysis
  - Focus groups
  - Observational methods
  - Tests
  - Document analysis
  - Key informants
  - Case studies

- Consider the cultural context, to make meaning of the data that have been collected

- Procedural ethics (e.g., Institutional Review Boards)

- Relational ethics (the connection between the evaluator and the evaluated)
## A Sample Logic Model

<table>
<thead>
<tr>
<th>Resources</th>
<th>Activities</th>
<th>Outputs</th>
<th>Outcomes</th>
<th>Impact</th>
</tr>
</thead>
</table>
| • NSF Funding  
• In-kind financial contributions from the University of Iowa  
• Principal Investigator  
• Co-Principal Investigators  
• Participating faculty mentors  
• Regular faculty advisors  
• Peer mentors  
• Support staff | • Recruitment  
• Orientation  
• Meetings between GEEMaP students and faculty advisors, peer mentors  
• Social events  
• Quantitative data collection  
• Qualitative data collection via surveys, interviews, focus groups | • Students recruited into the project  
• Website  
• Each cohort of GEEMaP students continue in the program  
• Publications  
• Presentations | • Student retention  
• Enhanced student satisfaction  
• GEEMaP students are retained  
• Early cohorts of GEEMaP students graduate | • More diverse quantitative science workforce  
• Career path is pursued by GEEMaP doctoral earners  
• Scientific contributions arising from the project |
AEIOU—An Evaluation Approach

• a(countability)
• e(ffectiveness)
• I(mpact)
• o(rganizational factors)
• u(nanticipated outcomes)
Evaluation Design

• Compared to what is a common evaluation question?
  – So, your REU produces totally awesome results
    • But—is that effect due to the REU?

• To RCT or not to RCT?
  – Randomized controlled trials
    • Requires ability to randomize REU treatment to some students (probably groups of students) and withhold it from others
  – Quasi-experimental methods
    • If you can’t randomize students to REU treatment/control, you should do your best to control for differences between REU and non-REU students

This is where you need to work closely with your friendly local project evaluator, and maybe with a research methodologist and/or statistician
Specifics for REUs

Formative evaluation to help project staff improve the local REU project

– identifying better ways of recruiting eligible students
– discovering obstacles that keep potential research mentors from participating
– examining the apparent strengths and weaknesses of the way this REU project is implemented

This could be done by the evaluator

– working with project staff to develop a logic model, to reveal any apparent gaps in the project’s rationale and lead to the creation of a better project plan
– observing the project in operation
– interviewing individuals from several groups
  • project staff
  • research mentors
  • undergraduate student participants
  • potential mentors and eligible students who did not participate
Thank you
Danke
Xie xie
Khawp khun
Yum တိုး
Mahalo
Salamat
Juspa
Obrigada
Spacibo
Arigato