NSF's Broader Impacts Criteria

Susan Burkett and Sue Kemnitzer
National Science Foundation

Annual ASEE Conference
June 18, 2006

Caution

Most of the information presented in this workshop represents the opinions of the individual program offices and not an official NSF position.

Warning on Generalizations

- NSF has several programs supporting undergraduate education
  - Different requirements
  - Different slants
- Proposal improvement ideas apply to all
  - But in varying degrees
- Choose ideas based on
  - Program solicitation
  - Judgment

Overview of Workshops

***Goal:* Prepare you to write more competitive proposals**

Three separate but related workshops
- **Proposal strategies**
- **Broader impacts**
- **Project evaluation**

Framework for the Workshop

Framework for the Workshop

- Learning situations involve prior knowledge
  - Some knowledge correct
  - Some knowledge incorrect (i. e., misconceptions)
- Learning is
  - Connecting new knowledge to prior knowledge
  - Correcting misconception
- Learning requires
  - Recalling prior knowledge – actively
  - Altering prior knowledge

Active-Cooperative Learning

- Learning activities must encourage learners to:
  - Recall prior knowledge -- actively, explicitly
  - Connect new concepts to existing ones
  - Challenge and alter misconception
- The think-share-report-learn (*TSRL*) process addresses these steps

7

Workshop Format

- "Working" Workshop
  - Short presentations (mini-lectures)
  - Group exercise
- Exercise Format
  - *Think → Share → Report → Learn*
    - *(TSRL)*
- Limited Time – May feel rushed
  - Intend to identify issues & suggest ideas
    - Get you started
    - No closure -- No "answers" – No "formulas"

8

Group Behavior

- Be positive, supportive, and cooperative
  - Limit critical or negative comments
- Be brief and concise
  - No lengthy comments
- Stay focused
  - Stay on the subject
- Take turns as recorder
  - Report for group not your own ideas

9

Workshop Format

- "Working" format
  - ½ to ¾ of time in team activities
- Limited time to complete activities
  - Frequently feel you need more time
- Purpose: identify, consider & discuss ideas
  - Get you started
  - No "answers"
  - No "formulas"

10

Workshop Background NSF Review Criteria

- NSF proposals evaluated using two review criteria
  - Intellectual merit
  - Broader impacts
- Most proposals
  - Intellectual merit done fairly well
  - Broader impacts done poorly

11

Workshop Goal

- To increase the community's ability to design projects that respond effectively to NSF's broader impacts criterion

12

Workshop Background NSF Strategies

- NSF proposals also evaluated relative to two principal strategies
  - Integrating research and education
  - Integrating diversity into NSF programs, projects, and activities
- Both reflected in the broader impacts criterion

13

Workshop Objective

- At the end of the workshop, participants should be able to
  - List categories for broader impacts
  - List activities for each category
  - Evaluate a proposed broader impacts plan
  - Develop an effective broader impacts plan

14

Conceptual Framework for the Workshop – Constructivist Model

- Learning situations involve prior knowledge
  - Some knowledge correct
  - Some knowledge incorrect (i. e., misconceptions)
- Learning is
  - Connecting new knowledge to prior knowledge
  - Correcting misconception
- Learning requires
  - Recalling prior knowledge – actively
  - Altering prior knowledge

15

Constructivist Model and Active-Cooperative Learning

- Learning activities must encourage learners to:
  - Recall prior knowledge -- actively, explicitly
  - Connect new concepts to existing ones
  - Challenge and alter misconceptions
- The think-share-report-learn (*TSRL*) process addresses these steps

16

Participation "Rules"

- In small group discussion
  - Be positive, supportive, and cooperative
    - Limit critical or negative comments
  - Be brief and concise in discussions
    - Avoid lengthy comments, stories or arguments
  - Stay focused
  - Get everyone involved
- In reporting to large group
  - Rotate reporters
  - Report group's views not your own
  - Be brief and concise in discussions

17

Workshop Approach

Information in "Learn" Phase, represents-

- ✓ "official" NSF positions
- ✓ NSF suggestions
- ✓ program officers' opinions

18

Broader Impacts Categories and Activities

Exercise -- Broader Impacts Categories

TASK:

- Identify the categories of activities responding to NSF broader impacts criterion
  - e, g., Increase participation of underrepresented groups

PROCESS:

- Think, share, report, learn

Statement of Broader Impacts Merit Review Criteria

- What are the broader impacts of the proposed activity?
  - 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?

Statement of Broader Impacts Merit Review Criteria (cont'd)

- Will the results be *disseminated* broadly to enhance scientific and technological understanding?
- What may be the *benefits* of the proposed activity to *society*?

"Relative Ease Quotient"

What, in your opinion, is the easiest activity to address in a typical proposal? What is the most difficult?

- Discovery and learning
- Broadening participation
- Infrastructure enhancement
- Dissemination
- Societal benefits

Exercise -- Dissemination Activities

TASK:

Identify activities that "broadly disseminate results to enhance scientific and technological understanding"

PROCESS:

- Think, share, report, learn

Dissemination -- NSF's Representative Activities I

- 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

Dissemination -- NSF's Representative Activities II

- *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.
- Integrate research with education activities in order to *communicate in a broader context*.

Converting Activity to Impact I

- Don't just list activities
  - More is not better
  - Describe the *impact* of activities
- Develop a *strategy* (a plan)
- Approach with same *detail* as intellectual content

Converting Activity to Impact II

- Develop a strategy (a plan)
  - Make *coherent* and consistent with
    - Institution's mission and culture
    - PI's interest and experience
  - *Integrate* with
    - Project activities
    - Intellectual merit
  - Include metrics and *evaluation*

Reviewing and Enhancing a Project's Broader Impacts

Exercise – Review Proposal's Broader Impacts

TASK:

- Write broader impacts section of a review
  - Outline format

PROCESS:

- Think, share, report, learn

Sample Proposal

- Real proposal
  - Project Summary
  - Excerpts from Project Description
- Assume
  - CCLI/Phase 1
  - $150k (total) for 2 years
  - Technical merit considered meritorious

Program Officers' Views – Review Comments I

- Scope of activities
  - Overall-very inclusive and good
  - Well done but "standard things"
  - Did not address the issue of quality
  - No clear-cut plan
  - Activities not justified by research base
- Dissemination
  - Limited to standard channels
  - Perfunctory

Program Officers' Views – Review Comments II

- Industrial advisory committee a strength
- Collaboration with other higher ed institutions
  - Institutions appear to be quite diverse but use of diversity not explicit
  - Interactions not clearly explained
  - Sends mixed message – raises questions about partnership effectiveness
- High school outreach
  - Real commitment not evident
  - Passive -- not proactive
  - High school counselors and teachers not involved

Program Officers' Views – Review Comments III

- Modules are versatile
- Broader (societal) benefits
  - Need for materials not well described
  - Value of the product not explained
  - Not clear who will benefit and how much
- Assessment of broader impacts not addressed

How would you rate this proposal?

- Excellent- 2 hands up
- Very Good- 1 hand up
- Good- 2 hands on head
- Fair- 1 hand on head
- Poor- forearms crossed

Exercise -- Enhancing Broader Impacts Effort

TASK:

Identify additional or enhanced broader impacts activities that will strengthen the project

PROCESS:

- Think, share, report, learn

NSF Program Officer's Suggestions -- Enhancing Broader Impacts Effort I

- Make activities appropriate to project
  - Establish a mentoring program for high school students
  - Use undergraduate students to interact with high school students
  - Connect to other projects if appropriate

NSF Program Officer's Suggestions -- Enhancing Broader Impacts Effort II

- Utilize entire PI team in development process
- Take better advantage of institutional diversity (e.g., assessment of impacts of materials on diversity
- Improve Dissemination
  - Add faculty workshops
  - Prepare exhibit for local museum

REFLECTION

Exercise -- Characteristics of Broader Impacts Plans

TASK:

- Identify desirable features of a broader impacts plan or strategy
  - General aspects or characteristics

PROCESS:

- Think, share, report, learn

NSF Program Officer's Suggestions -- Characteristics of Broader Impacts Plan I

- Include strategy to achieve impact
  - Have a well-defined set of outcome objectives
  - Make results meaningful and valuable
  - Make consistent with technical project tasks
  - Have detailed tasks for implementation and evaluation (did it work & why?)
  - Have a well stated relationship to the audience or audiences

NSF Program Officer's Suggestions -- Characteristics of Broader Impacts Plan II

- Don't use "tack on" evaluation and dissemination plans
- Investigate and discuss other broader impacts plans
- Include target group(s) in development
- Be creative!

Exercise -- Reflection on Broader Impacts

TASK:

- Identify the most interesting, important, or surprising idea you encountered in the workshop

PROCESS:

- Think, share, report, learn

WRAP-UP

Summary-Broader Impacts I

- Use and build on NSF suggestions
  - List of *categories in solicitations*
  - *Representative activities on website*
    - Not a comprehensive checklist
    - *Expand* on these -- be creative
- Develop activities to show *impact*
- *Integrate and align* with other project activities

Summary-Broader Impacts II

- Help reviewers (and NSF program officers)
  - Provide sufficient *detail*
    - Include objectives, strategy, evaluation
  - Make broader impacts *obvious*
    - Easy to find
    - Easy to relate to NSF criterion

Summary-Broader Impacts III

- Make broader impacts *credible*
  - Realistic and believable
    - Include appropriate funds in budget
  - *Consistent* with
    - Project's scope and objectives
    - Institution's mission and culture
    - PI's interest and experience
- Assure *agreement* between Project Summary and Project Description

REFERENCES

Grant Proposal Guide
http://www.nsf.gov/pubs/gpg/nsf04_23/

Broader Impacts Activities
http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf

Thanks for your active participation!

Questions?