Proposal Writing Strategies

Barb Anderegg and Susan Burkett
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

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"

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

Workshop Agenda

- Enhancement strategies
  - General aspects
  - Goals, objectives, and outcomes
  - Rationale
  - Realities of the review process
- Exercise on selected strategy

Workshop Outcomes

After the workshop, you should be able to:

- Identify areas where proposals can be enhanced
  - Made more competitive
- Generate a list of suggestions for each area

NSF's Engineering Education Support

- NSF funds research and development proposals on engineering education
- Two main programs
  - EHR/DUE -- Course, curriculum and laboratory improvement
    - Deadline: I/10/07 & probably 5/07
  - ENG/EEC -- Engineering education research
    - Deadline: 8/15/06
- Others – check the website

EHR/DUE's CCLI Program

Vision: Excellent STEM education for all undergraduate students.

Goal: Stimulate, disseminate, and institutionalize innovative developments in STEM education through the production of knowledge and the improvement of practice.

Components:

- Material & pedagogy development
- Faculty development
- Implementation
- Assessment
- Research

ENG/EEC's Engineering Education Research Program

Vision: Basic understanding to enable the transformation undergraduate and graduate engineering education

Goal: Deeper understanding of how students learn engineering

Research Areas:

- Aims and objectives of engineering education
- Content and organization of the curriculum
- How students learn problem solving, creativity & design
- New methods for assessment and evaluation
- Attracting a more talented and diverse student body

Reflective Exercise (1)

Identify the single most important piece of advice you would give to a colleague writing a proposal on curriculum development

- Materials, pedagogy, laboratory

- This will be a continuing exercise
- Write your answer
- Leave space for more answers

Turning a Good Idea into a Competitive Proposal

Scenario: Origin of a Curriculum Development Proposal

- *Prof X has taught* Signal Processing *at U of Y for several semesters.*
- *She has an idea for* greatly improving *the course by adding "new stuff"*
  - *"New stuff"*
    - *Material (e. g., modules, web-based instruction)*
    - *Activities (e. g., laboratories, projects)*
    - *Pedagogy (e. g., problem based learning)*
- *She has done some preliminary evaluation*
- *She decides to prepare a CCLI proposal*

Professor X's Initial Proposal Outline

- Problem Statement:
  - Items describing the problem as she sees it
- Proposed Approach:
  - Items describing how the the "new stuff" will look
- Proposed Activities:
  - Items describing how she will develop "new stuff"
- Schedule:
  - Items describing the timing of the development

Better Initial Proposal Outline

- ***Goals:*** Develop "*new stuff*" to enhance student learning at U of Y
- ***Rationale:*** Observed shortcomings in educational experience of the students at U of Y and felt that *new stuff* would improve the situation
- ***Project Description:*** Details of "*new stuff*"
- ***Evaluation:*** Use U of Y's course evaluation forms to show difference
- ***Dissemination:*** Describe "*new stuff*" using conference papers, journal articles, and web site

Exercise 1
Proposal Strategy

As a colleague, provide a few suggestions to guide Prof. X as she develops her curriculum development proposal

PD's response to Proposal Strategies

- Read the program solicitation
  - Determine how your ideas match the solicitation and how you can improve the match
- Articulate goals, objectives, & outcomes
  - Outcomes should include improved student learning
- Build on existing knowledge base
  - Review the literature
  - Present evidence that the "new stuff" is doable; will enhance learning; is the best approach
- Explore potential collaborations

PD's response to Proposal Strategies

- Use data to document existing shortcomings in student learning
- Describe management plan
  - Provide tasks, team responsibilities, timeline
- Provide clear examples of the approach
- Integrate the evaluation effort early
  - Build assessment tools around defined objectives and expected outcomes
  - Connect with independent evaluation experts

PD's response to Proposal Strategies

- Identify strategies for dissemination
  - Define a plan to contribute to knowledge base
  - Address broader impacts
  - Collaborate, form partnerships (build community)

Write Proposal to Answer Reviewers' Questions

What are you trying to accomplish? What will be the outcomes?	*Goals etc.*
Why do you believe that you have a good idea? Why is the problem important? Why is your approach promising?	*Rationale*
How will you manage the project to ensure success? How will you know if you succeed?	*Evaluation*
How will others find out about your work? How will you interest them? How will you excite them?	*Dissemination*

Aspects of Research Proposal

- Similar for research proposal
  - Research question
  - Rationale
  - Methodology
  - Impact
- Same for faculty development proposal
- Same for assessment proposal

Goals → Objectives → Outcomes

Developing Goals & Outcomes

- Start with one or more overarching statements of project intention
  - Each statement is a *goal*
- Convert each goal into one or more expected measurable results
  - Each result is an *outcome*

Goals – Objectives – Outcomes -- Questions

- Converting goals to outcomes may involve intermediate steps
  - Intermediate steps frequently called *objectives*
    - More specific, more measurable than goals
    - Less specific, less measurable than outcomes
- Outcomes (goals) lead to questions
  - These form the basis of the evaluation
  - Evaluation process collects and interprets data to answer evaluation questions

Definition of Goals, Objectives, and Outcomes

Goal – Broad, overarching statement of intention or ambition
- A goal typically leads to several objectives

Objective – Specific statement of intention
- More focused and specific than goal
- A objective may lead to one or more outcomes

Outcome – Statement of expected result
- Measurable with criteria for success

NOTE: No consistent definition of these terms

Exercise 2: Identification of Goals/Outcomes

- Read the abstract
  - Note - Goal statement removed
- Suggest two plausible goals
  - One focused on a change in learning
  - One focused on a change in some other aspect of student behavior

Abstract

The goal of the project is …… The project is developing computer-based instructional modules for statics and mechanics of materials. The project uses 3D rendering and animation software, in which the user manipulates virtual 3D objects in much the same manner as they would physical objects. Tools being developed enable instructors to realistically include external forces and internal reactions on 3D objects as topics are being explained during lectures. Exercises are being developed for students to be able to communicate with peers and instructors through real-time voice and text interactions. The material is being beta tested at multiple institutions including community colleges. The project is being evaluated by … The project is being disseminated through …

PD's Response -- Goals

- Goals may focus on
  - Cognitive behavior
  - Affective behavior
  - Success rates
  - Diversity
    - Cognitive, affective or success in targeted subgroups

PD's Response – Goals on Cognitive Behavior

GOAL: To improve understanding of

- Concepts & application in course
  - Solve textbook problems
  - Draw free-body diagrams for textbook problems
  - Describe verbally the effect of external forces on a solid object
- Concepts & application beyond course
  - Solve out-of-context problems
  - Visualize 3-D problems
  - Communicate technical problems orally

PD's Response – Goals on Affective Behavior

GOAL: To improve

- Interest in the course
- Attitude about
  - Profession
  - Curriculum
  - Department
- Self- confidence
- Intellectual development

PD's Response – Goals on Success Rates

- Goals on achievement rate changes
  - Improve
    - Recruitment rates
    - Retention or persistence rates
    - Graduation rates

PD's Response – Goals on Diversity

GOAL: To increase a target group's

- Understanding of concepts
- Achievement rate
- Attitude about profession
- Self-confidence

- *"Broaden the participation of underrepresented groups"*

Exercise 3: Transforming Goals into Outcomes

Write one expected measurable outcome for each of the following goals:

1. Increase the students' understanding of the concepts in statics
2. Improve the students' attitude about engineering as a career

PD's Response -- Outcomes

Conceptual understanding

- *Students will be better able to solve simple conceptual problems that do not require the use of formulas or calculations*
- *Students will be better able to solve out-of-context problems.*

Attitude

- *Students will be more likely to describe engineering as an exciting career*
- *The percentage of students who transfer out of engineering after the statics course will decrease.*

Project Rationale

Project Rationale

- Rationale is the narrative that provides the context for the project
  - It's the section that connects the "*Statement of Goals and Outcomes*" to the "*Project Plan*"
- What's the purpose of the rationale?
  - What should it contain?
  - What should it accomplish?
- What should an applicant include in their rationale?
  - What topics should a PI address?

Exercise 4 An Effective Rationale

Write a list of of questions that the *Rationale* for a CCLI proposal should answer

(pay particular attention to questions the reviewer will expect answered)

TSRL

PD's Response An Effective Rationale

- What does the knowledge base say about the approach?
  - What have others done that is related?
  - What has worked previously?
  - What have been the problems/challenges?
- Why is this problem important?
  - Is it a global or local problem?
  - What are the potential broader impacts?
  - How will it improve quality of learning?

PD's Response
An Effective Rationale

- What is the evidence that the approach will solve the problem?
  - Address the defined outcomes?
  - Achieve the defined outcomes?
  - Improve student learning?
- What are alternate approaches?

PD's Response
An Effective Rationale

- What are the potential problems & limitations?
  - What can be done about them?
- Has the applicant done prior work?
  - Has funded work lead to interesting results?
  - Are there any preliminary data and what do they show?

Reflective Exercise (2)

Identify the single most important piece of advice you would give to a colleague writing a proposal

Write it down with your original answer

Evaluation

Project Evaluation Plan

- All projects require evaluation
  - All proposal require an evaluation plan
- During the project, evaluation:
  - Monitors progress toward goals
  - Identifies problems
- At the end of the project, evaluation:
  - Tells you what you accomplished
  - Provides data for you to use in telling others

Exercise 5
Evaluation Plan

Read the sample *Evaluation Plan* and list suggestions for improving it

Sample Evaluation Plan

- Assessment of the Student Response Technology (SRT) will be both quantitative and qualitative. First, students will be surveyed at the end of the semester on the content, level of difficulty, and their perceived level of mastery of the concepts of Statics. Second, faculty members teaching the course using SRT will be asked to judge its effectiveness in monitoring student achievement throughout the semester. In addition, faculty members who have been teaching Statics course for several years will be asked to compare students' abilities after using SRT with those in previous years who have not used SRT. Finally, the final grades of students using SRT will be compared with those from previous years who have not used the technology in the classroom.

PD's Response Evaluation Plan (1)

- Include formative assessment
  - Provides feedback during the design and implementation phases
  - Helps monitor progress toward outcomes

PD's Response Evaluation Plan (2)

- Get help at the beginning – in the proposal writing phase
  - Involve an expert evaluator
  - Consider an outside (independent) evaluator
    - Size of budget
    - Importance of objectivity

PD's Response Evaluation Plan (3)

Consult other sources

- *NSF's User Friendly Handbook for Project Evaluation*
  - http://www.nsf.gov/pubs/2002/nsf02057/start.htm
- Existing tools
  - Online Evaluation Resource Library (OERL)
    - http://oerl.sri.com/
  - Field-Tested Learning Assessment Guide (FLAG)
    - http://www.wcer.wisc.edu/archive/cl1/flag/default.asp
- Science education literature
  - *J. of Engineering Education*, Jan, 2005

PD's Response Evaluation Plan (4)

- Provide details on tools & experimental design
  - Describe how
    - Students will be "surveyed",
    - Faculty will be "asked",
    - Grades will be "compared"
  - Indicate who will do these tasks
  - Indicate who will analyze and interpret the data
  - Consider confounding factors
  - Try to measure deeper learning
  - Collect demographic data on student populations

PD's Response Evaluation Plan (5)

- Consider broadening the approach
  - Examine effects on retention and diversity
  - Involve larger populations
    - More diverse populations
  - Collaborate
  - Beta test

Dissemination

(Contributing to Knowledge Base & Building Community)

Effective Dissemination Plans

- *Education&D projects need dissemination plan*
- *CCLI projects need to contribute to:*
  - *The STEM education knowledge base*
  - *Building the STEM education community*
- *How does a proposal convince the reader (the reviewer or program officer) that the project will:*
  - *"Contribute to the STEM education knowledge base"?*
  - *"Help build the STEM education community"?*

Exercise 6

Effective Dissemination Plan

Read the sample *Dissemination Plan* and list suggestions for improving it

Sample Dissemination Plan

This project will serve as a pilot for other courses at the University of ____ and at other colleges and universities throughout the country. The results of our evaluation will be disseminated on the University's web site, which will contain a special page devoted to this NSF-sponsored project. Additional dissemination will occur through presentations at conferences, such as teacher education and science education conferences, regionally and nationally, and through articles published in peer-reviewed journals.

PD's Response

Dissemination Plan (1)

- Be more proactive in promoting website & materials
- Integrate community building , dissemination, and evaluation

PD's Response

Dissemination Plan (2)

- Target and involve a specific sub-population
  - Those who teach similar course at other locations
  - Ask them to review various products, data, and approaches
  - Work with them to organize
    - Email exchanges and listserves
    - Informal meeting at a conference or on-campus
    - Faculty development workshops (on-campus and at conferences)
- Explore beta test sites

PD's Response
Dissemination Plan (3)

- Be specific about how the project will serve as a "pilot"
  - Strategy for evaluating and disseminating
  - Strategy for getting "buy-in" by others

PD's Response
Dissemination Plan (4)

- Be more specific in publication efforts
  - Indicate the specific conferences and journals
    - Include conference travel and journal page charges in budget
    - Include a tentative title & description of paper
  - Explore other venues
    - CUR (http://www.cur.org/), PKAL (http://www.pkal.org), State Academy of Science meetings
    - Science news publication and lay press
    - Professional society and specialty listserves

PD's Response
Dissemination Plan (5)

- Explore commercialization
  - Discuss contacts with software and textbook publishers
- Put material in a form suitable for the National Science Digital Library (NSDL)

Review Process -- Practical Aspects

Practical Aspects of Review Process

Reviewers have:

- Many proposals
  - Ten or more from several areas
- Limited time for your proposal
  - 20 minutes for first read
- Different experiences in review process
  - Veterans to novices
- Different levels of knowledge in proposal area
  - Experts to outsiders
- Discussions of proposals' merits at panel meeting
  - Share expertise and experience

Exercise 7
Practical Aspects of Review Process

Write a list of suggestions (guidelines) that a colleague should follow to deal with these practical aspects

Abbreviated TSRL

PD's Response Review Process

- Use good style (clarity, organization, etc.)
  - Be concise, but complete
  - Write simply but professionally
  - Avoid jargon and acronyms
  - Check grammar and spelling
  - Use sections, heading, short paragraphs, & bullets (Avoid dense, compact text)
- Reinforce your ideas
  - Summarize them; Highlight them (bolding, italics)
- Give examples

PD's Response Review Process

- Provide appropriate level of detail
- Pay special attention to Project Summary
  - Summarize goals, rationale, methods, and evaluation and dissemination plans
  - Address intellectual merit and broader impacts
    - Explicitly and independently
    - Three paragraphs with headings:
      - "Summary"
      - "Intellectual Merit"
      - "Broader Impacts"

PD's Response Review Process

- Follow the solicitation and *GPG*
  - Adhere to page, font size, and margin limitations
    - Use allotted space but don't pad the proposal
  - Follow suggested (or implied) organization
  - Use appendices sparingly (check solicitation to see if allowed)
  - Include letters showing commitments from others
    - Avoid form letters

PD's Response Review Process

- Prepare credible budget
  - Consistent with the scope of project
  - Clearly explain and justify each item
- Address prior funding when appropriate
  - Emphasize results
- Sell your ideas but don't over promote
- Proofread the proposal
- "Tell a story" and Turn a good idea into a competitive proposal

Reflective Exercise (3)

Identify the single most important piece of advice you would give to a colleague writing a CCLI proposal

Write it down with your earlier answers

Questions and Concerns During Proposal Preparation

- Read the solicitation and the *GPG*
- Get advice - NSF program directors & experienced colleagues
- "Imaginary panel"(Experts, novices, in-field/out)
  - How would they respond to a question?
  - How would they react to an idea? To a written section?
  - What else would they like to see?
  - What questions will they have?
- Use your judgment

Don't include a poorly developed section because someone told you that it is needed

Conclusion

Presentation at:
http://www.nsf.gov/events/

Read the solicitation!
Read the *GPG!*

Read the solicitation!
Read the *GPG!*