Writing Competitive Education Proposals for NSF

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Exercise
Most Important Proposal Writing Ideas

- Identify the two most important ideas to remember when writing a NSF education proposal

- Write them down and set the paper aside

Caution

- Most of the information presented in this workshop represents the opinion of an individual program officer and is not an official NSF position
- Use judgment in applying workshops suggestions because NSF requirements and expectations vary among NSF programs
  - Your mileage may vary
  - Void where prohibited by law
  - Talk to your doctor before writing a proposal
  - Professional drivers on a closed track

Workshop Goals & Outcomes

Goal:
   Prepare you to write more competitive NSF education proposals

Measurable Outcomes:
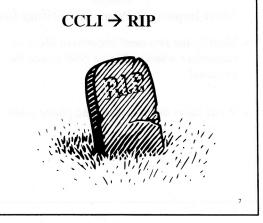   After the workshop, you should be able to:
   - Identify areas where proposals can be enhanced
   - Generate a list of suggestions for each area

Workshop Format

- **Practice What We Preach**
- **"Working" Workshop**
  - Short presentations (mini-lectures)
  - Group exercises
- **Exercise Format**
  - *Think → Share → Report → Learn*
- **Limited Time – May feel rushed**
  - Intend to identify issues & suggest ideas
  - Get you started

Participation "Rules"

- **In small group discussions**
  - Be concise in discussions
  - Stay focused
  - Get everyone involved
  - Be positive, supportive, and cooperative
- **In reporting to large group**
  - Rotate reporters
  - Report group's views, not your own
  - Be concise

CCLI → RIP

TUES
Transforming Undergraduate Education in STEM

TUES 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.**

TUES vs CCLI

- Title changed to encourage projects that have the potential to transform undergraduate STEM education
- Review criteria modified to emphasize the desire for projects that
  - Propose materials, processes, or models that have the potential to
    - Enhance student learning and
    - Be adapted easily by other sites
  - Involve a significant effort to facilitate adaptation at other sites

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NSF Review Criteria

- **All proposals are evaluated using identical review criteria**
  - *Intellectual merit*
  - *Broader impact*
- **Two sets of questions to help define these criteria**
  - Standard NSF set
  - TUES-specific set

Questions for Intellectual Merit

- *Will the project*
  - **Produce exemplary material or practices?**
  - **Involve qualified proposer(s)?**
  - **Contain creative and transformative concepts?**
  - **Have a well conceived and organized plan?**
  - **Build on STEM education knowledge?**
  - **Generate useful evaluation information?**

Questions for Broader Impacts

- *Will the project*
  - **Lead to a broad impact on STEM education?**
  - **Help build the STEM education community?**
  - **Broaden participation of underrepresented groups?**
  - **Include broad dissemination?**

Proposal Strengths and Weaknesses Study

Data Collection

- **Analyzed the strengths and weaknesses identified in Panel Summaries**
  - **CCLI Phase 1 engineering proposals from 2005 and 2006**
- **Coded the Panel Summaries for 471 proposals**
- **Identified the most common strengths and weaknesses cited in these panel summaries**

Exercise
Strengths & Weaknesses Identified by Reviewers

- **Predict the results of our analysis**
- **List what you think will be**
  - **The three most frequently cited strengths**
  - **The three most frequently cited weaknesses**
- **TSRL**
  - **Think individually (2 mins)**
  - **Share with the group (3 mins)**
  - **Report**
  - **Learn from PD comments**

Top Seven Strengths and Weaknesses

Rank	Strengths	Weaknesses
1	Important, timely topics & responsive to needs	Insufficient detail and unclear plans
2	PIs are strong	Evaluation plan is incomplete
3	Collaboration details	Unrealistic activities & not related to outcomes
4	Potential for involving women and minorities	Limited dissemination plan
5	Dissemination good & contributes to knowledge base	Limited potential for involving women and minorities
6	Large impact	Does not build on prior work
7	Builds on prior work or products	Not innovative or novel

Proposal Sections

- **Goals & expected measurable outcomes**
- **Rationale**
  - **Introduction**
  - **Background**
  - **Justification**
- **Project Plans**
  - **Implementation strategy**
  - **Evaluation strategy**
  - **Dissemination strategy**
  - **Management strategy**

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 specific expected measurable results
  - Each result is an *outcome*
- Outcomes lead to questions
  - These form the basis of the evaluation

PD's Response

- The goals should be:
  - Unambiguous
  - Addressing student learning, student attitudes
  - Ambitious and achievable
  - Innovative
  - Responsive to the solicitation
  - Relevant to a timely issue

Potential Goals

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

Goals for Cognitive Behavior

- To improve the understanding of:
  - Concepts & application in a course
  - Concepts & application beyond course

Goals for Affective Behavior

- To improve:
  - Intellectual development
  - Self- confidence
  - Interest in the course
  - Attitude about the:
    - Profession
    - Curriculum

Goals for Success Rates

- To improve:
  - Recruitment rates
  - Retention or persistence rates
  - Graduation rates

Goals for Diversity

- **To increase a target group's:**
  - **Understanding of concepts**
  - **Achievement rate**
  - **Attitude about profession**
  - **Self-confidence**
- **To broaden the participation of under-represented groups**

Transforming Goals into Outcomes

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

  1. **Increase the students' understanding of the concepts in *some topic***

  2. **Improve the students' attitude about computing as a career**

PD's Response

- **The Outcome Statements should:**
  - **Be clearly and concisely stated**
  - **Reflect each of the stated goals**
  - **Be measurable (reliable)**
  - **Truly reflect what you want to measure (valid)**

Possible Outcomes

- **Conceptual understanding**
  - **Students will be better able to analyze circuits**
  - **Students will be better able to observe a circuit's output and make modifications to produce a desired outcome**

- **Attitude**
  - **Students will be more likely to describe computing as an exciting career**
  - **The percentage of students who transfer out of the major after the Introductory Course will decrease**

Possible Evaluation Questions

- **Conceptual understanding:**

  - ***Did the students' ability to solve problems using loops increase because of the in class exercises?***

- **Attitude:**

  - ***Did the students' discussions indicate they were more excited about computing as a career?***

Strengthening the Rationale

- **Indicate the topics that should be addressed in the rationale to address the common strengths and weaknesses?**
- **TSRL**
  - **Think individually (2 mins)**
  - **Share with the group (3 mins)**
  - **Report**
  - **Learn from PD comments**

An Effective Rationale

- An effective rationale discusses
  - The importance of the problem (industry needs, emerging area)
  - The potential impact of the work (large number of students, global)
  - Prior work by others
  - Prior work by you (preliminary data)
  - Potential contributions to teaching and learning
- Don't limit to Intellectual merit -- also include broader impacts

Purpose of Rationale

- The rationale should convince the reader that the applicant
  - Has identified an important, big-impact problem
  - Understands the problem and the prior work
  - Has thought about the broader impacts in general and broadening participation in particular

Exercise
Strengthening the Evaluation Plan

- Indicate some topics that should be included in an effective evaluation plan
- TSRL
  - Think by yourself (2 min)
  - Share with group (3 min)
  - Report
  - Learn from PD comments

Evaluation Plan

- Name & qualifications of the evaluation expert
- Goals and outcomes
- Tools & protocols for evaluating each outcome
- Analysis & interpretation procedures
- Formative evaluation techniques for monitoring and improving the project as it evolves
- Summative evaluation techniques for characterizing the accomplishments of the completed project.

Purpose of Evaluation Plan

- The evaluation plan should convince the reader that the applicant
  - Has clear measurable expected outcomes
  - Will collect, analyze, and interpret appropriate data
  - Will complete an informative evaluation both for monitoring (formative) and for validating (summative)

Examples of Tools for Evaluating Learning Outcomes

- **Surveys**
  - **Forced choice or open-ended responses**
- **Interviews**
  - **Structured or Free Form**
- **Focus groups**
  - **Like interviews but with group interaction**
- **Observations**
  - **Actually monitor and evaluate behavior**
- **Direct Measurements_**

Additional Resources

- *NSF's User Friendly Handbook for Project Evaluation*
- Online Evaluation Resource Library (OERL)
- Student Assessment of Their Learning Gains (SALG)
- Science education literature

NSF Handbook

- User Friendly Handbook for Project Evaluation
  - http://www.nsf.gov/pubs/2002/nsf02057
- PDF document (84 pages)
- Topics
  - Types of Evaluation
  - Steps in Doing an Evaluation
  - Data Collection Methods
  - Additional Resources
  - Finding an External Evaluator

OERL

- Online Evaluation Resource Library
  - http://oerl.sri.com
- Dozens of Samples
  - Plans
  - Instruments
  - Reports
- Additional Information
  - Papers
  - Professional Development Modules

SALG

- Student Assessment of Their Learning Gains
  - http://www.salgsite.org/
- Develop on-line student surveys
- Adapt or create your own
- Validated questions to choose from

Exercise
Strengthening the Dissemination Plan

- Indicate some components of a strong dissemination plan
- TSRL
  - Think individually (2 mins)
  - Share with the group (3 mins)
  - Report
  - Learn from PD comments

PD's Response
Dissemination Plan

- Include specifics in description of publication efforts
  - Conference or journal, budget, tentative title, purpose
- Put material in a form suitable for NSDL
- Target and involve a specific population
  - Community building
  - Faculty workshops
- Explore commercialization
- Explore beta test sites (early adopters)

Purpose of Dissemination Plan

- The dissemination plan should convince the reader that the applicant
  - Will have something to disseminate
  - Has plans to inform and encourage others and to facilitate their use of your innovation

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
Practical Aspects of Review Process

- **Write a list of suggestions (guidelines) that a colleague should follow to deal with these practical aspects**
- **TSRL**
  - Think individually (2 mins)
  - Share with the group (3 mins)
  - Report
  - Learn from PD comments

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
- **Write for "skimming"**
  - Summarize and highlight key points
  - Use sections, heading, short paragraphs, & bullets
- **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
  - Three paragraphs with headings:
    - "Summary"
    - "Intellectual Merit"
    - "Broader Impacts"

PD's Response
Review Process

- **Follow the solicitation and *GPG***
  - *Grant Proposal Guide* (GPG)
  - Adhere to page, font size, and margin limitations
  - Follow suggested (or implied) organization
  - 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
- Proofread the proposal
- "Tell a story" and turn a good idea into a competitive proposal

Scenario -- Developing a Proposal Idea

Developing a Proposal Idea

- Professor Plum has taught a course for several semesters
- She has an idea for "greatly improving" the course by adding or adapting *new stuff*
  - *new stuff* = laboratory, web experience, interactive set of material, workbook, new text
- She tried some preliminary material
- Based on this, she decided to prepare an NSF proposal

Proposal Outline

- Goal: Develop or adapt *new stuff* to enhance student learning at State University
- Rationale: Observed shortcomings in the students at State University & felt that *new stuff* would improve the situation
- Project Plan: "Details of *new stuff* "
- Evaluation: Conduct course evaluations when using *new stuff*
- Dissemination: Describe *new stuff* using conference papers, journal articles, and web site

Exercise
What's Wrong?

- Prepare a list of suggestions for improving this proposal outline
  - Think individually (2 mins)
  - Share with the group (3 mins)
  - Report
  - Learn from PD comments

What's Wrong? -- Goals

- Develop a broader focus for the project
- Indicate the development, evaluation, and assessment are the real goals
  - Not "enhanced learning of students at State University"
- Define measurable learning outcomes
  - Define in terms of student behavior

What's Wrong? -- Rationale

- Discuss and reference the literature
  - Show a knowledge of others' work
- Describe experience at other schools
- Indicate why approach is new and innovative
- Discuss the likelihood of success
- Discuss effects on retention and broader participation

What's Wrong? -- Evaluation

- Use an assessment expert
  - Collaborate with faculty colleague
  - Use external evaluator for independent evaluation
- Use formative and summative evaluation
- Include beta test at one or more other sites
- Tie evaluation to goals and objectives
  - Include measures of student learning
- Include impact statement

What's Wrong? -- Dissemination

- Include collaboration with faculty members in other schools
- Include an outreach component
  - K-12 or community colleges
- Include beta testing at other school(s)
- Include faculty workshops for training

What's Wrong? -- Broader Impact

- Describe the broader impact
- Include preliminary data, research data
- Form a collaborative effort
- Include a plan with timeline, milestones, deliverables, and responsibilities
- Include meaningful letters of support
  - Avoid "template" letters

Exercise
Most Important Proposal Writing Ideas

- Identify the two most important ideas to remember when writing a NSF educational development proposal

- Write them down on the piece of paper you used earlier

How Did We Do?

Goal:
  Prepare you to write more competitive NSF education proposals

Measurable Outcomes:
  After the workshop, you should be able to:
  - Identify areas where proposals can be enhanced
  - Generate a list of suggestions for each area