Overview of the NSF IUSE Program and Tips for Submitting Proposals

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Division of Undergraduate Education (DUE)
Directorate of Education and Human Resources (EHR)
National Science Foundation
Workshop Outline

• Overview of IUSE
  – History /Evolution of IUSE
  – IUSE Today
  – Review Criteria
  – IUSE Abstract Exercise (Misconceptions)

• Review Process
  – Tips for Reviewers
  – Reviewing Exercise

• Submitting Proposals
  – Tips for Submitting Good Proposals
An Introduction to IUSE

- Improving Undergraduate STEM Education
- NSF Division of Undergraduate Education’s (DUE) largest program
  
  1104 proposals were submitted during the 2014 fiscal year
  ~1164 proposals were submitted during the 2015 fiscal year

- First Year (2013)
  - No Solicitation – only an Announcement
  - “There will not be an additional solicitation for IUSE. Any proposal should be about improving undergraduate STEM education and should produce new knowledge about what works effectively.”

- A Very Flexible Program
NSF IUSE Project Objectives

- Increase student retention in STEM
- Prepare students to participate in science for tomorrow
- Improve students' STEM learning outcomes
- Generate knowledge on how students learn and on effective practice in undergraduate classrooms
- Broaden participation
- Improve STEM Education knowledge through
  - Building upon fundamental research in undergraduate STEM education and prior R&D
  - Research on design, development, and wide-spread implementation of effective STEM learning/teaching knowledge and practice
  - Foundational research on student learning
Educational Practice and Research Cycle

Educational Practice → Answers Insights → Educational Research → Questions Ideas → STEM Learning Environment

Which help improve... → Identifies and motivates...

That results in... → Which lead to...

Which helps improve... → Identifies and motivates...

That results in... → Which lead to...

Division of Undergraduate Education
Directorate of Education and Human Resources
National Science Foundation
IUSE: EHR

2 tracks

Engaged Student Learning

Research, Design, and Development studies that involve creation, exploration, and implementation of tools, resources, or models

Institutional and Community Transformation

Projects that use innovative approaches to substantially increase the propagation of highly effective methods of STEM teaching and learning in institutions of higher education
IUSE Tracks

• Engaged Student Learning
  – Exploration ~100 < $250k
  – Design and Development, Level I ~15 < $600k
  – Design and Development, Level II ~20 < $2M

• Institutional and Community Transformation
  – Exploration ~40 < $250k
  – Design and Development ~10 < $3M
The Evolution of IUSE

2000

STEP

STEM Talent Expansion Program

2005

CCLI

Course, Curriculum, & Laboratory Improvement

2010

TUES

Transforming Undergraduate Education in Science, Technology, Engineering, & Mathematics

WIDER

Widening Implementation & Demonstration of Evidence-Based Reforms

IUSE

Improving Undergraduate STEM Education
The Evolution of IUSE

- CCLI – Course, Curriculum, & Laboratory Improvement – 1998
  - the consolidation of three programs
The Evolution of IUSE

• **STEP – STEM Talent Expansion Program**
  - Building upon fundamental research in undergraduate STEM education and prior R&D
  - Supports the preparation of a globally-competitive workforce (including future teachers) and a scientifically literate populace by increasing the number of students receiving associate or baccalaureate degrees in established or emerging fields within STEM
  - research-generating approaches
    - to understanding STEM learning;
    - to designing, testing, and studying curricular change and innovation;
    - to disseminating and implementing best practices;
    - and to broadening participation of individuals and institutions in STEM fields.
The Evolution of IUSE

- CCLI existed relatively unchanged for a dozen years
  - Minor tweaks – lowering the bar for national dissemination
  - Around 2010, there was a growing awareness at NSF that CCLI was aiming at too small of a target
The Evolution of IUSE

- CCLI became TUES
  - Transforming Undergraduate Education in Science, Technology, Engineering, & Mathematics
  - Greater emphasis on the need for a project to be “Transformative”
The Evolution of IUSE

- Around 2011, there was a growing awareness at NSF that all projects can’t be transformative – there was a need to simply spread the use of the “tried and true”

- The program WIDER (Widening Implementation & Demonstration of Evidence-Based Reforms) was created
The Creation of IUSE

- In 2013, there was a second major program consolidation
- TUES + STEP + WIDER = IUSE
The Evolution of IUSE

CCLI
- Course, Curriculum, & Laboratory Improvement

CCD
- Course & Curriculum Development

STEP
- STEM Talent Expansion Program

TUES
- Transforming Undergraduate Education at STEM Institutions

IUSE
- Improving Undergraduate STEM Education

UFE
- Undergraduate Faculty Enhancement

WIDER
- Widening Implementation & Demonstration of Evidence-Based Reforms

KAPOW!
## FY 2014 – EHR/DUE IUSE Awards

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Number of Proposals</th>
<th>Standard Grants</th>
<th>Continuing Grants</th>
<th>Other Types</th>
<th>Number of Awards</th>
<th>% of Awards by Discipline</th>
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<tbody>
<tr>
<td>BIO</td>
<td>20</td>
<td>2</td>
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<td>5</td>
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<td>Computer Science</td>
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<td>2</td>
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<tr>
<td>ENG</td>
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<td>3</td>
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<td>3</td>
<td>42</td>
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<tr>
<td>GEO</td>
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<td>0</td>
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<tr>
<td>MATH</td>
<td>9</td>
<td>1</td>
<td></td>
<td>0</td>
<td>10</td>
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<tr>
<td>Physics</td>
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<td>3</td>
<td></td>
<td>0</td>
<td>13</td>
<td>7.2%</td>
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<tr>
<td>Interdisciplinary</td>
<td>26</td>
<td>1</td>
<td></td>
<td>1</td>
<td>28</td>
<td>15.5%</td>
</tr>
<tr>
<td>Institutional Change</td>
<td>21</td>
<td>1</td>
<td></td>
<td>0</td>
<td>22</td>
<td>12.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,104</strong></td>
<td><strong>158</strong></td>
<td><strong>13</strong></td>
<td><strong>10</strong></td>
<td><strong>181</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

**IUSE Funding Rate** = 181/1104 = 16.4%

**Phys/Ast Funding Rate** = 7/41 = 17.1%
## FY 2014 – EHR/DUE IUSE Awards

<table>
<thead>
<tr>
<th>Discipline</th>
<th>FY 2014 - Discretionary Funds</th>
<th>FY 2014 H-1B</th>
<th>% of Award Funding by Discipline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSF EHR Obligations</td>
<td>Co-Funding Obligations</td>
<td>Total EHR &amp; R&amp;RA Obligations</td>
</tr>
<tr>
<td>BIO</td>
<td>$11,773,425</td>
<td>$823,769</td>
<td>$12,597,194</td>
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<tr>
<td>CHEM</td>
<td>2,801,483</td>
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<td>2,801,483</td>
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<tr>
<td>Computer Science</td>
<td>2,914,410</td>
<td>504,629</td>
<td>3,419,039</td>
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<td>ENG</td>
<td>7,788,518</td>
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<td>8,238,518</td>
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<tr>
<td>GEO</td>
<td>2,827,469</td>
<td>-</td>
<td>2,827,469</td>
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<tr>
<td>MATH</td>
<td>1,916,426</td>
<td>900,000</td>
<td>2,816,426</td>
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<tr>
<td>Physics</td>
<td>1,569,828</td>
<td>175,000</td>
<td>1,744,828</td>
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<tr>
<td>Interdisciplinary</td>
<td>10,938,581</td>
<td>-</td>
<td>10,938,581</td>
</tr>
<tr>
<td>Institutional Change</td>
<td>15,908,470</td>
<td>100,000</td>
<td>16,008,470</td>
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<tr>
<td>Total</td>
<td>$58,438,610</td>
<td>$2,953,398</td>
<td>$61,392,008</td>
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<tr>
<td>STEP, TUES, WIDER</td>
<td>$16,106,390</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total IUSE</td>
<td>$74,545,000</td>
<td></td>
<td></td>
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</table>
IUSE Phys/Ast Funded Projects 2014

- Workshops and Learning Communities for Physics and Astronomy Faculty
- Multimedia modules for physics instruction in a flipped classroom course for pre-health and life science majors.
- Examining the Development of Student Reasoning Skills Through Scaffolded Physics Instruction
- Surveying the state and implications of computational physics in courses for physics majors
- Undergraduate Students' Epistemology and Expectations of Experimental Physics
- Developing Scientific Reasoning: Targeted Physics Instruction for STEM Majors
- Foundational Research on Problem Mathematization in Undergraduate Physics
We received 34 proposals in physics/astronomy for the fall 2014 Exploration tracks.

We received 37 proposals/17 projects in physics/astronomy for the spring 2015 Exploration tracks. (and still need reviewers :-)

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NSF Merit Review Criteria

Guiding Principles

• All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.

• Meaningful assessment and evaluation of NSF-funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects.
NSF Merit Review Criteria

Required

Both criteria are to be given full consideration during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient.

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge

- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes

Merit Review Considerations

The following elements should be considered in the review for both Intellectual Merit & Broader Impacts:

• What is the potential for the proposed activity to:
  ▪ Advance knowledge and understanding within its own field or across different fields (Intellectual Merit)?
  ▪ Benefit society or advance desired societal outcomes (Broader Impacts)?

• To what extent does the proposed activity suggest and explore creative, original or potentially transformative concepts?
(Merit Review Considerations cont.)

The following elements should be considered in the review for both Intellectual Merit & Broader Impacts:

• Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale?

• Does the plan incorporate mechanisms to assess success?

• How well qualified is the individual, team, or institution to conduct the proposed activities?

• Are there adequate resources available to the PI (either at the home institution or through collaborations) to carry out the proposed activities?
Common Guidelines for Education Research & Development: **NSF13-126**

- Offer *guidance* on building the evidence base in STEM learning

- Are not a “requirement” for IUSE: EHR proposals, but may be helpful to proposers and reviewers

- We encourage you to be familiar with them
Basic perspectives from the Common Guidelines for IUSE: EHR Projects

• Should be both “knowledge -using” and “knowledge-producing.”
  – Using: Is the project building on prior work?
  – Producing: What will “we” learn from the planned conduct of this project?

*Perspective: It is OK for IUSE: EHR projects to serve the PI’s institution, but they should also serve all of us by providing useful knowledge for broad constituencies of educators
(Basic Perspectives cont.)

- Applied work (e.g. development) is fine as long as it adheres to the principles of the preceding slide. *NSF budgets are not large enough to support simple local improvement projects.*

- While we call for innovation, *replication* is also acceptable and an important part of science. *How do we know that something is effective if has been tested at only one place?*
IUSE Abstracts Exercise

• How well do you think these projects would do in the IUSE program? Please think about them individually and jot down a few thoughts.

• Then break into small groups (2 or 3) and discuss. Can you reach a consensus?
Proposal Abstract Feedback

• Can IUSE fund equipment?
  – Telescopes, upper division physics lab equipment, studio physics/astronomy equipment

• Does IUSE fund “local” professional development?

• Maybe – if there is a “novel niche” (capabilities, curriculum, research findings, etc.) that benefit the entire community
  – There are too many schools for NSF to improve the situation at one particular school.
Who reviews - What and How?

• You Do!

• In our panels we include reviewers that are
  
  – Experts in fields of STEM education, STEM content, methodology, cognitive science, and administration

  – Typically 5 reviews

  – Panelists typically read 10 – 12 proposals, (but panels may include more than 12 proposals and thus you will not read every proposal assigned to the panel)

  – It will take around 2 hours per proposal. Reviews should be “completed” and submitted in Fastlane before the panel.

  – IUSE is using a mix of virtual and face to face panels.
The Proposer Receives:

Reviews

Panel Summary (if applicable)

Context statement & Award/Declination letter

anonymous
Use the Entire Proposal to Inform Your Review:

- Project Summary (1 page)
- Project Description (15 pages)
- Biographical Sketches
- Budget
- Letters of Commitment
- Project Data Form
- Current & Pending Support
Individual Review Process:

Rating the Proposal

• Assign only **ONE** rating: E, V, G, F, P
• Do **NOT** assign split ratings, such as E/V or V/G
• Your rating **MUST** be consistent with your written review
Individual Review Process: Writing Your Review

Within FastLane:

- In your own words, write aspects you find to be compelling and those that you believe will benefit from improvement; *Do NOT cut and paste text from the proposal into your review*
- Be sure that your written review is consistent with your rating
- It is OK to modify reviews during the panel meetings, including a change of rating
- Be sure any modifications to reviews are recorded in FastLane! *MUST be done BEFORE the panel is closed.*
- Note that many MS Word symbols do not translate in FastLane - check your work after submitting
Characteristics of Informative Reviews

• Include a section for IM, BI and summary
• Use appropriate style (*positive tone*)
• Contain adequate details
• Write understandable, specific, and complete statements
• Relate strengths and weaknesses, supported by detailed explanation, associated with review criteria
• If an item would have helped to strengthen the proposal, a clear statement should be included as to why that would be the case.
Review Evaluation Exercise

- Sample reviews have been passed out
- Please evaluate their usefulness to a program officer and the investigator (first individually and then with peers)
- You have 10 minutes!
During the panel:

• Each proposal will typically have 4 or 5 reviewers
• Each proposal will have a reviewer assigned as the Scribe/Lead Discussant (called the primary panelist)
• The Scribe/Lead Discussant will write the panel summary as well as write an individual review
• Panel members assigned to review the proposal are called secondary panelists.
• Panel members not assigned to review the proposal are simply identified as “panelists.”
Proposal Discussion

• The Scribe/ primary panelist is the lead discussant who presents an overview of the project being proposed.

• The Scribe then provides the “highlights” of her/his own review

• Each assigned “secondary” panelist will provide his/her individual “highlights” while the scribe takes notes

• Additional discussion will include all panelists providing the scribe with sufficient information to be able to compose the Panel Summary
Panel Summaries

For each proposal:

- Initially framed by primary panelist who serves as scribe
- Should reflect the panel discussion (not just restate individual reviews)
- Include short, clear comments to help PIs improve their projects
- Should be written in 3rd-person, as the panel, and will be read and agreed to by all panelists
Characteristics of Informative Panel Summaries

- Includes a section for IM, BI and summary
- Uses appropriate style (*positive tone*)
- Contains adequate details
- Contains understandable, specific, and complete statements
- Relates strengths and weaknesses, supported by detailed explanation, associated with review criteria
- If an item would have helped to strengthen the proposal, a clear statement should be included as to why that would be the case
Tips for Proposal Writing
Before You Place Pen to Paper

• Serve as a reviewer for the program
• Investigate Program Websites
• Search the Award Database
• Read Appropriate Solicitation (> twice)
• **Contact the Program Director**
  - One or two paragraph describing projects (one-pager?)
  - Possible phone call to talk about the project
• Possible co-review if inter/cross-disciplinary
Proposal Writing
Before You Place Pen to Paper II

In Program Announcement/Solicitation, look for:

• Goal of Program
• Eligibility
• Special proposal preparation and/or award requirements
• Deadlines/Target dates/ Submission windows
• Pre/Full proposal

In case of a conflict between the GPG and the solicitation, the solicitation overrides the GPG
Things to consider

• **Why do it?**

• **Why you and not someone else?**
  - Uniqueness of research, educational opportunities, available facilities...

• **What are your strengths?**
  - Capture the reviewers’ attention in the summary and introduction. Make them want to read more.

• **YOU must convince the reviewer you are worthy of funding (overcome skepticism)**

• **Express yourself clearly**
  - It’s not the reviewer’s job to figure out what you are trying to accomplish and why
Proposal Preparation

- Proposal & Award Policies & Procedures Guide (PAPP) NSF 14-1
  - Combination of the Grant Proposal Guide (GPG) and the Award & Administration Guide (AAG)
  - Contains guidelines for all proposals (except when program solicitation stipulates otherwise)
  - Provides guidance for Award process, from issuance and administration through closeout
  - Describes NSF organizations and offices most relevant to grantees
  - Provides a list of Statutes and Executive Orders referenced in PAPP
Potential Pitfalls

- References
  - See Grant Proposal Guide Chapter II, Section C.2e
  - All Authors, Titles of Articles

- Biographical Sketch
  - See Grant Proposal Guide Chapter II, Section C.2f.
  - Collaborators, Advisors, Advisees

- Intellectual Merit & Broader Impact in Project Summary

- Project Description
  - Results from Prior NSF support

- Human Subjects (Require IRB approval)
- Post Doc Mentoring – One page in Supplementary Docs
- Data Maintenance Plan – Two pages in Supplementary Docs

Non-conforming proposals may be returned without review!!!
Sections of a Proposal

- Cover Sheet
- Project Summary
- Table of Contents
- Project Description: Research and Broader Impacts
- References
- Biographical Sketches
- Budget
- Current and Pending Support
- Facilities, Equipment, and Other Resources
- Special Information and Supplementary Documentation:
  - Short letters of commitment to collaborate NOT Support
  - Post-Doc Mentoring
  - Data Maintenance
Last suggestions

• Don’t wait until the deadline to submit

• **Download and Print** the PDF file after finishing and double-check the font size, diagrams, etc.

• Different Program Officers may handle things differently but you are always safer if you follow GPG and solicitation guidelines

• Get someone else (with experience) to read the proposal, and leave your ego behind

• Get someone from your research (sponsored programs) office to read it and scrutinize (about a month before the deadline)
Division of Undergraduate Education

Improving Undergraduate STEM Education Program (IUSE: EHR)

Questions?

Comments?

Thank You!