Webinar on NSF’s Improving Undergraduate STEM Education: Education and Human Resources (IUSE: EHR) Program

Overview and Focus of the Program

For proposals submitted to NSF 19-601

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This session is being recorded

By participating in the session, you are giving permission to record your questions and comments.
What would you like to do?

- Improve students’ performance and retention in STEM courses and majors?
- Increase participation of women and students from underrepresented groups in STEM courses and majors?
- Prepare students to enter the STEM workforce?
- Increase faculty engagement with their STEM teaching?
- Make your institution a better place for STEM teaching and learning?

Stay tuned to learn more about the IUSE: EHR program...
Webinar agenda

• Introduction to the IUSE: EHR Program
• Brainstorming – what do you want to do?
• IUSE: EHR Program organization
  • Tracks and levels
  • Workshop and conference submissions
• Program Expectations
• NSF Review Criteria – Intellectual Merit and Broader Impacts
• Resources
• Just for NEW to NSF (if time permits)

Note: The webinar will include several Q&A sessions. Participants will use the Q&A box in the platform to ask questions.
Introduction to the IUSE: EHR Program
IUSE: EHR hopes to...

• Improve the quality and effectiveness of the education of undergraduates in all STEM fields

• Improve undergraduate STEM teaching and learning for all students and/or the institutional environment where they occur
Who can apply?

• Proposals are accepted from all types of institutions of higher education and from professional societies and organizations that work with or represent those institutions
What institutional types has IUSE funded?
What do you want to do?
Brainstorming – what have you been longing to do to improve undergraduate STEM education?

• **Action**: Write down three things you have been wanting to do to improve STEM teaching and/or learning.

• **Review**: Look at your ideas. Which one is most compelling to you?

• **Reflect**: What would it take to implement your idea? Money? People? Collaborators?

• **Plan**: Keep your idea in mind as a target for an IUSE proposal.
IUSE: EHR Program Organization

Engaged Student Learning
Institutional and Community Transformation
Levels, Funding, and Deadlines
IUSE: EHR Program Organization

Two program tracks:

- **Engaged Student Learning**: development, testing, and use of teaching practices and curricular innovations that will engage students and improve learning, persistence, and retention in STEM

- **Institutional and Community Transformation**: transformation of colleges and universities to implement and sustain highly effective STEM teaching and learning
Engaged Student Learning

• Focuses on improving student learning (directly or indirectly)
• Supports development of improved instructional materials and/or methods
• Aims to engage students, improve learning, and increase retention in STEM
Engaged Student Learning

Range of approaches including (but not limited to):

- Development and implementation of novel instructional methods and technologies
- Design and assessment of metrics to measure STEM teaching and learning or student outcomes
- Faculty learning through professional development
- Discipline-based or interdisciplinary educational research
- Re-envisioning or adaptation of learning environments
- Co-curricular activities that increase student motivation and persistence in STEM
- Synthesis or meta-analysis of prior work
- Collaborations between 2-year and 4-year institutions to develop innovative pathways for transfer and student success
Target populations for ESL projects

• Students at two- and four-year institutions
• STEM majors (declared and undeclared)
• Students whose course of study require solid skills and knowledge of STEM principles
• Non-STEM majors seeking to fulfill a general education requirement in STEM
• STEM faculty members
• Pre-Service STEM teachers in *undergraduate* teacher preparation programs
Institutional and Community Transformation

• Focuses on improving evidence-based instruction by academic departments, institutions, and other organizations or communities

• Supports efforts to build and understand systemic change in undergraduate STEM education

• Aims to use appropriate theories of change to transform institutions

Note: AAAS will host another webinar on November 13, 2019 specifically focused on Institutional and Community Transformation proposals
Institutional and Community Transformation

Range of approaches including (but not limited to):

- Transformation of high-enrollment classes to include evidence-based teaching practices
- Developing teaching evaluation rubrics rooted in a research-based framework
- Development of faculty communities to improve accessibility or sustainability of evidence-based practices
- Identifying best practices to guide institutional transformation
- Inclusion of non-tenure-track faculty or instructors through policy or professional development
- Identification of common elements across disciplines, programs, institutions, or systems that support students from underrepresented groups to be successful in STEM
Institutional and Community Transformation proposals should....

• Describe **theory of change**.

• Include **research literature and theoretical perspectives** concerning change.

• Recognize STEM higher education as a **complex system**.

• Promote institutional change and include:
  • **Teams** of faculty members
  • **Support** from the department chairs, college deans, or others within the institution's academic leadership
  • **Support** from Provosts or Presidents
## IUSE: EHR Tracks and Levels

### Engaged Student Learning
- Increasing engagement and learning through new tools, resources and models
- Generating knowledge about student learning

### Institutional and Community Transformation
- Spreading and scaling up evidence-based practices using a “theory of change”
- Generating knowledge about the organizational change process

### Level 1:
- $\leq 300k$, up to 3 years

### Level 2:
- $300k - 600k$, up to 3 years

### Level 3:
- $600k - 2M$, up to 5 years

### Capacity-Building:
- $150k$ for single institution or $300k$ for multiple institutions, up to 2 years
- Level 1: $\leq 300k$, up to 3 years
- Level 2: $300k - 2M$ for single institution or $3M$ for multiple institutions, up to 5 years
Program Deadlines

• Level 1 and Capacity-Building proposals:
  • February 4, 2020 (and the first Tuesday in February thereafter)
  • August 4, 2020 (and the first Tuesday in August thereafter)

• Level 2 and Level 3 proposals:
  • December 4, 2019 (and the first Tuesday in December thereafter)
Workshops and Conferences

• Proposals for workshops and conferences addressing critical challenges in undergraduate STEM education may be submitted at any time.

• Depending on size and scale of the workshop or conference, these proposals typically include budgets between $20,000 and $100,000.

• Proposers must consult an NSF Program Officer (in the IUSE: EHR program) before submission to determine appropriateness of the proposed workshop or conference for IUSE: EHR.
Workshops and Conferences

Conference and workshop proposals addressing diversity in STEM teaching and learning and those involving collaborations of educational researchers and disciplinary scientists to ensure that STEM teaching reflects cutting-edge STEM disciplinary research are especially encouraged.
Questions?
Program Expectations
## IUSE: EHR Program Goals

<table>
<thead>
<tr>
<th>Goal</th>
<th>Description</th>
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<tbody>
<tr>
<td>To build knowledge about STEM teaching and learning at the undergraduate level</td>
<td>Develop novel, creative, and transformative approaches to undergraduate STEM teaching and learning</td>
</tr>
<tr>
<td>To incorporate evidence-based practices in STEM teaching and learning for all undergraduates</td>
<td>Adapt, improve, replicate, and include evidence-based practices in STEM teaching and learning</td>
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<tr>
<td>To build and understand systemic change in undergraduate STEM education</td>
<td>Lay the groundwork for sustained departmental, institutional, or community transformation and improvement</td>
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Gaining new knowledge

All IUSE: EHR proposals are expected to increase knowledge about effective STEM education through

- Posing one or more research questions OR
- Evaluation of project activities, impacts, or outcomes
Successful IUSE proposals will...

• **Build on what is known**, summarizing published literature and defining a starting point that extends the prior work
• **Include a well-designed plan to gather data**
• **Specify methods of analysis** that will be employed to answer the questions posed
• **Include mechanisms to evaluate** the success of the project (both formative and summative evaluation)
• Explain how findings and materials will be **shared**
• **Address the sustainability of project efforts**
• **Collaborate** as needed with other investigators, institutions, or communities
Methods of Analysis

• Align research or evaluation methods with the questions posed
• Select appropriate methods to perform the study. These may be:
  • Qualitative
  • Quantitative
  • A mixture of both
IUSE Fact Check (True or False?)

• Q1: All proposals must have a research component.
  • False, but all proposals must generate new knowledge.

• Q2: STEM curriculum development, programmatic pathways, learning resources, assessment instruments, and faculty development may receive funding.
  • True

• Q3: Proposals may focus on both STEM and non-STEM majors
  • True, efforts to improve undergraduate STEM education for either or both is appropriate.

• Q4: Proposals may focus solely on students in a single discipline.
  • True, as well as on multidisciplinary or interdisciplinary STEM education.

• Q5: An evaluation plan that provides formative and summative assessment of the effectiveness of the project in achieving its goals is required.
  • True

• Q6: Proposals should demonstrate a solid grounding in relevant literature on STEM teaching and learning.
  • True

• Q7: Only colleges and universities may submit proposals
  • False, all categories of proposers in the PAPPG are eligible (including professional societies, companies, nonprofit organizations, etc.)
Which of the following may receive IUSE funding?

- **Use and build evidence** about improved STEM instructional practices
- **Investigate novel instructional tools or learning systems**, including cyberlearning
- **Create, implement, and test program, curricular, course, and technology-driven models** for STEM teaching and learning
- **Develop, implement, and test creative approaches for adoption of education research into disciplinary teaching**
- **Develop and validate assessments/metrics** for undergraduate STEM learning and instructional practice; and
- **Propagate and sustain transformative and effective STEM teaching and learning** through institutional practices or involvement of professional societies

**Answer**—ALL of the above
Questions?
NSF Merit Review Criteria

- Intellectual Merit
- Broader Impacts
Merit Review Criteria

**Intellectual Merit (IM):** What is the potential for the proposed activity to advance knowledge and understanding within its own field or across fields?

- What will we learn from the work?

**Broader Impacts (BI):** What is the potential for benefitting society or advancing desired societal outcomes?

- Why is the work important to society?
Intellectual Merit (unpacked)

Intellectual merit may consist of

- The potential to advance **knowledge** and understanding within its own field or across different fields;
- The **PI and team’s** capability in conducting the development and knowledge generation;
- The access to the necessary **resources**, including unfunded collaborations to conduct the proposed work;
- A clear **plan** for what the project will do, who will do it, when it will be done, and **why**;
- A mechanism to assess the **success** of the proposed projects’ attempts to advance knowledge and understanding and provide feedback to the PI and team.
Broader Impact (unpacked)

Societally relevant outcomes may include, but are not limited to:

- Full participation of women, persons with disabilities, and underrepresented minorities in STEM
- Improved STEM education and educator development at any level
- Increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society
- Development of a diverse, globally competitive STEM workforce
- Increased partnerships between academia, industry, and others
- Improved national security
- Increased economic competitiveness of the US
- Enhanced infrastructure for research and education.
Other review considerations

• To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

• Is the plan for carrying out the proposed activities well-reasoned, well organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?

• How 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?

Please Note: Reviewers are also asked to review Facilities, Equipment and Other Resources, Data Management Plan, Postdoctoral Researcher Mentoring Plan, and required Supplementary Documents.
Is it IM or BI?

In addition to development and implementation of a novel curriculum, the project will include educational research to uncover new information about undergraduate model-based-reasoning through detailed assessment of classroom learning.

- Intellectual merit
Is it IM or BI?

Activities planned will provide in-depth faculty development through a national series of workshops, and an expansion of an ongoing national study of the effectiveness of this approach for learning about the nature of science.

• Broader Impact
Questions?
IUSE: EHR Program Resources

IUSE: EHR Program web page:
https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505082

IUSE: EHR Program solicitation (NSF 19-601):

Conduct a search of previously funded awards at
https://www.nsf.gov/awardsearch/

Contact a program officer (names and contact info are available on the program web page)
Additional helpful resources

NSF Proposal and Award Policies & Procedures Guide

Common Guidelines for Education Research and Development

NSF Merit Review Overview
https://www.nsf.gov/bfa/dias/policy/merit_review/

The Art and Science of Reviewing Proposals video
https://tipsforreviewers.nsf.gov/

NSF Building Capacity in STEM Education Research (BCSER) solicitation
https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505645
THANK YOU for your participation in today’s webinar and for your interest in improving undergraduate STEM education.

Stay tuned if you are new to NSF and would like additional information about the proposal preparation and submission process.
Are you (or your institution) new to NSF?
Nuts and bolts of NSF proposals

• Proposal components

• What makes for a compelling proposal?

• Submitting a proposal

• What happens after proposal submission?
Proposal components

• Cover Page
• Table of Contents
• Project Summary (1-Page)
• Project Description (15-Pages)
• References Cited
• Biographical Sketch(es)
• Budget and Budget Justification
• Current and Pending Support
• Facilities, Equipment and Other Resources
• Special Information and Supplementary Documentation
• Data Management Plan
• Postdoctoral Mentoring Plan (if applicable)
• Single Copy Documents
  • Collaborators & Other Affiliations Information
Project summary (1 page)

Each proposal must contain a one-page summary of the proposed project that includes:

- Project overview
- Intellectual merit statement
- Broader impacts statement

NOTE: Label the statement on Intellectual Merit and the statement on Broader Impacts
Project description (15 page limit)

• Must contain, separately within the narrative, a section labeled “Intellectual Merit”.

• Provides a clear statement of the work to be undertaken.

• Includes the objectives for the period of the proposed work and expected significance.

• Indicates the relationship of this work to the present state of knowledge in the field, as well as to work in progress by the PI under other support.

• Outlines the general plan of work, including the broad design of activities to be undertaken, and, where appropriate, provides a clear description of experimental methods and procedures.

• Addresses what you want to do, why you want to do it, how you plan to do it, how you will know if you succeed, and what benefits could accrue if the project is successful.
Project description (continued)

• The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified. These issues apply to both the technical aspects of the proposal and the way in which the project may make broader contributions.
Project description (continued)

- must contain, separately within the narrative, a section labeled “Broader Impacts”
- provides a discussion of the broader impacts of the proposed activities of the proposal and how they will be obtained

**Note:** Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to the project.

**Note:** NSF values the advancement of scientific knowledge and activities that contribute to the achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the US; and enhanced infrastructure for research and education.
Project description (continued)

Brevity will assist reviewers and Foundation staff in dealing effectively with proposals.

• The project description (including Results from Prior NSF Support, which is limited to five pages) may not exceed 15 pages

• Visual materials, including charts, graphs, maps, photographs and other pictorial presentations are included in the 15-page limitation

• The project description must be self-contained and URLs must not be used, nor may appendix material be added to supplant the page limitation
Elements of an Assessment and Evaluation Plan
(included within the 15-page Project Description)
FORMATIVE SUMMATIVE

WHEN THE CHEF TASTES THE SOUP

WHEN THE GUESTS TASTE THE SOUP

FROM STEVE WHEELER’S BLOG “THE AFL TRUTH ABOUT ASSESSMENT”

What makes a proposal competitive?

• Original ideas
• Succinct, focused project plan
• Realistic amount of work
• Sufficient detail provided
• Cost effective
• High impact
• Knowledge and experience of PIs
• Contribution to the field
• Rationale and evidence of potential effectiveness
• Likelihood the project will be sustained
• Objective feedback, solid evaluation plan (or advisory board in some circumstances)
Preparing a competitive proposal

• Start with a good idea
• Communicate clearly
• Address the two merit review criteria: IM and BI
• State research objectives and questions as well as plans for evaluation
• Have plans for carrying out the proposed work
• Ground the project in relevant and appropriate literature (perhaps outside of STEM education!)
• Get appropriate expertise on board
• Ask colleagues (in and out of your field) to read and critique your proposal
Preparing a competitive proposal (cont.)

• Include strong arguments for importance of the problem
• Make sure STEM content is clearly articulated (include examples!)
• Make sure research design and methodology are appropriate and sufficiently discussed
• Sensible chain of reasoning links literature review, process for development, research questions, data, and analyses
• Impacts of the research and development addressed
Tips for success

• Start EARLY!
• Read the program solicitation ([NSF 19-601](https://www.nsf.gov)) carefully
• Consult the NSF Proposal & Award Policies & Procedures Guide (PAPPG) ([NSF 19-1](https://www.nsf.gov)) for proposal preparation instructions
• Test drive FastLane ([https://www.fastlane.nsf.gov/fastlane.jsp](https://www.fastlane.nsf.gov/fastlane.jsp))
• Alert your Sponsored Research Office
• Follow page and font size limits
• Be aware of other projects and advances in the field
• Cite the relevant literature
• Provide details
• Discuss prior results (if you have them)
• Include evaluation plan with timelines and benchmarks
Tips for success (continued)

• Put yourself in the reviewers’ place
• Consider reviewers’ comments if resubmitting proposal
• Have someone else read the proposal
• Spell check; grammar check
• Meet deadlines
• Follow NSF requirements for proposals involving Human Subjects
• Call or email NSF Program Officers for guidance as needed
Proposal submission

• Proposals must be submitted electronically through FastLane (https://www.fastlane.nsf.gov/fastlane.jsp) or through Grants.gov (https://www.grants.gov/web/grants). Submission through Fastlane is highly recommended.
NSF’s Proposal review process

**PHASE I**
1. OPPORTUNITY ANNOUNCED
2. PROPOSAL SUBMITTED
3. PROPOSAL RECEIVED

**PHASE II**
4. REVIEWERS SELECTED
5. PEER REVIEW
6. PROGRAM OFFICER RECOMMENDATION
7. DIVISION DIRECTOR REVIEW

**PHASE III**
8. BUSINESS REVIEW
9. AWARD FINALIZED
Questions?
THANK YOU for your interest in improving undergraduate STEM education!