Improving Undergraduate STEM Education: Education and Human Resources (IUSE: EHR) Program

Institutional and Community Transformation Track

For proposals submitted to NSF 19-601

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Directorate for Education and Human Resources
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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
• IUSE: EHR Program Organization
• Special Focus: Institutional and Community Transformation Track
  • Theory of Change
  • Capacity Building, Level 1, and Level 2
• Resources

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

• Undergraduate 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 (ICT)

• 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
Institutional and Community Transformation (ICT)

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
Questions?
Institutional and Community Transformation (ICT) 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
Theory of Change

A theory of change functions to identify and organize the dimensions of the proposed work....

While proposed projects will vary in approach and the underlying theory/theories of change identified, promising proposals will recognize that STEM higher education is a complex system and that achieving goals involves analyzing and addressing organizational factors, such as institutional policies and practices or opportunities for professional growth.

IUSE:EHR Solicitation 19-601
Theories of change can drive programs as well as people. A program seeking to effect change or reform often tacitly reflects the theories of change of the program’s designers. Because reformers tend to jump from identifying a problem to choosing ways of ameliorating it, they often do not articulate the reasons why those strategies will achieve the desired changes—that is, the program’s theory of change. Theories of change matter because they are usually implicit, and what remains unseen cannot be questioned.

Theory of Change: Drawing Upon the Literature

Structural Frame
Human Resource Frame
Political Frame
Symbolic (or Cultural) Frame

Bolman & Deal (2017) Reframing Organizations (6th Ed.)
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Searching for Funded ICT Projects From Last Year
Searching for Prior Awards

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Strategies for Searching for Prior ICT Awards

Activity:

What other search terms might you use to identify ICT awards from prior years? Please click the red “Ask a Question” button to compose suggestions and hit the “Submit” button.
Sample Awards
Testing a Model for Transforming STEM General Education at Liberal Arts Schools (1611663)

Jacqueline Roberts jroberts@depauw.edu (Principal Investigator)
Pamela Propsom (Co-Principal Investigator)
Michael Roberts (Co-Principal Investigator)

Institution: DePauw University
This project's goal is to test an integrated bottom-up/top-down model of institutional reform within a college of liberal art's STEM division. The broad strategy is to provide momentum to fuel a transition from an active "mobilization" stage of this faculty-driven initiative to subsequent stages: "implementation" and then "institutionalization." Initial grassroots efforts have led to base-level support for division-wide engagement of this goal. This model of change is focused on moving the STEM faculty towards significant course transformation reflective of the growing evidence base indicating "what works" while simultaneously developing a productive STEM learning community.
Testing a Model for Transforming STEM General Education at Liberal Arts Schools (1611663)

This will be accomplished partly through curriculum reform awards that would be made to individuals or faculty teams to redesign their courses or to develop new, team-taught interdisciplinary courses. Linked to the awards are "best practices" pedagogical workshops that also engage interdisciplinary faculty teams from other institutions.
Testing a Model for Transforming STEM General Education at Liberal Arts Schools (1611663)

This project is building on the work of Ann Austin [Promoting evidence-based change in undergraduate science education. Paper presented at the Fourth Committee Meeting on Status, Contributions, and Future Directions of Discipline-Based Education Research, 2011] and Susan Elrod and Adrianna Kezar [Facilitating interdisciplinary learning: Lessons learned from Project Kaleidoscope. Change: The Magazine of Higher Learning, Jan-Feb 2012]. The institution itself will add additional diversity to the group of institutions supported by EHR grants working to achieve institutional transformation.
Integrating and Scaffolding Research into Undergraduate STEM Curricula: Probing Faculty, Student, Disciplinary, and Institutional Pathways to Transformational Change (1625354)

Elizabeth Ambos eambos@cur.org (Principal Investigator)
Kerry Karukstis (Co-Principal Investigator)
Mitchell Malachowski (Co-Principal Investigator)
Jeffrey Osborn (Co-Principal Investigator)
Jillian Kinzie (Co-Principal Investigator)

Institution: Council on Undergraduate Research
Integrating and Scaffolding Research into Undergraduate STEM Curricula: Probing Faculty, Student, Disciplinary, and Institutional Pathways to Transformational Change (1625354)

To achieve a cohesive curriculum that initiates students into a culture of inquiry and research in the discipline, departments will use a backward design approach to develop scaffolded, research-rich courses and assignments that build in deliberate ways to guide students to greater independence and ownership of their learning.

Two overarching research questions will be examined: (1) What effect do student characteristics (e.g., pre-existing academic preparation, current course performance) have on student-learning experiences and outcomes in a scaffolded inquiry-driven curriculum? (2) How do different departmental approaches and distinct disciplinary cultures impact the integration of the components and outcomes of undergraduate research into the curriculum?
A mixed-methods approach will be used to address these questions, including surveys, focus groups with students and faculty, observations and interviews with faculty and team consultants, annual progress reports, and in-depth site visits. A novel aspect of this project will be the development of both standardized and experimental questions on the National Survey of Student Engagement and the Faculty Survey of Student Engagement. These surveys will allow for comparison of project institutions with national results.

The theory of change model that develops from this project will allow a broad and diverse range of institutional types and departments/disciplines to assess their readiness for research-scaffolded curricula and provide key insights into the effects of such curricular transformation on student achievement and organizational and cultural change.
Evaluating the Potential of Community College Guided Pathways Reforms to Increase Undergraduate STEM Student Success (1915191)

Paul Jenkins davisjenkins@gmail.com (Principal Investigator)
Thomas Brock (Co-Principal Investigator)

Institution: Teachers College, Columbia University
Evaluating the Potential of Community College Guided Pathways Reforms to Increase Undergraduate STEM Student Success (1915191)

The project team will partner with higher education agencies in three states that are leading statewide community college Guided Pathways reforms: Ohio, Tennessee, and Washington.

The goals of the project are to evaluate how these Guided Pathways reforms are changing practices in STEM programs, advising, and other supports; what barriers and facilitators college and STEM program leaders face in implementing these reforms; what metrics colleges should use to formatively evaluate the effects of these reforms on STEM program effectiveness; and what relationship exists between Guided Pathways reforms and enrollment, early progress, and persistence in undergraduate STEM programs by community college students generally and by underrepresented students in particular.
Evaluating the Potential of Community College Guided Pathways Reforms to Increase Undergraduate STEM Student Success (1915191)

The research design is based on a mixed methods approach that will include field research to assess the scale of implementation of Guided Pathways reforms, statistical analysis of student unit records, and qualitative analysis of interview and focus group data. Resulting analyses will be the basis of practitioner-focused reports and briefs and peer-reviewed journal articles.

The study is designed to inform college practices and public policy through the identification and validation of metrics. The project team will produce a practitioner guide that includes metrics that for formative use to evaluate the effects of Guided Pathways reforms on STEM outcomes. The team will also produce a practitioner guide on how community colleges can leverage ongoing community college Guided Pathways reforms to improve access to and completion of undergraduate STEM programs.
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Questions?
### IUSE: EHR Tracks and Levels

<table>
<thead>
<tr>
<th>Engaged Student Learning</th>
<th>Institutional and Community Transformation</th>
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<tbody>
<tr>
<td>• Increasing engagement and learning through new tools, resources and models</td>
<td>• Spreading and scaling up evidence-based practices using a “theory of change”</td>
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<tr>
<td>• Generating knowledge about student learning</td>
<td>• Generating knowledge about the organizational change process</td>
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<table>
<thead>
<tr>
<th>Level</th>
<th>Budget and Duration</th>
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<tr>
<td>Level 1:</td>
<td>$\leq 300k$, up to 3 years</td>
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<tr>
<td>Level 2:</td>
<td>$300k - 600k$, up to 3 years</td>
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<tr>
<td>Level 3:</td>
<td>$600k - 2M$, up to 5 years</td>
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<th>Capacity-Building:</th>
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<td>$150k$ for single institution or $300k$ for multiple institutions, up to 2 years</td>
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<tr>
<td>Level 1: $\leq 300k$, up to 3 years</td>
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<tr>
<td>Level 2: $300k - 2M$ for single institution or $3M$ for multiple institutions, up to 5 years</td>
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Program Deadlines

• Level 1 and Capacity-Building proposals:
  • February 2, 2021 (and the first Tuesday in February thereafter)
  • August 3, 2021 (and the first Tuesday in August thereafter)

• Level 2 and Level 3 proposals:
  • December 1, 2020 (and the first Tuesday in December thereafter)
ICT Capacity Building

ICT Capacity-Building proposals may be submitted as individual or collaborative projects. The maximum award size is $150,000 for a single institution proposal or $300,000 for a multi-institution proposal. The maximum duration of both single and multi-institutional proposals is two years.
Capacity Building

Capacity-Building proposals are expected to enable institutions that have not served as the lead institution on a prior ICT award to identify a project of interest. Funding for these projects is intended to support efforts to assess institutional needs, formulate departmental and/or institutional commitments, develop necessary campus partnerships, audit prior institutional efforts, gather data, learn about relevant theories of change, identify relevant institutional practices and policies, and/or formulate plans for advancing institutional or community transformation.
Capacity Building

Proposers are encouraged to include a variety of participants such as disciplinary or educational researchers, assessment and evaluation experts and advisors, and institutional leaders. Funds awarded for ICT Capacity-Building proposals are intended to defray costs such as coordinating among project participants, sharing data, and attending relevant meetings including IUSE: EHR PI meetings. The project timeframe is intended to allow institutions to host one or more working meetings at which stakeholders and potential research partners might ultimately develop an ICT Level 1 or Level 2 proposal.
Level 1 Description

ICT Level 1 proposals have a maximum award size of $300,000 and a maximum duration of three years. Awards at this level are intended for early-stage exploratory projects or small to mid-scale projects that build on prior work.

There are two deadlines annually for ICT Level 1 project submissions. The deadlines are February 2, 2021 and August 3, 2021 and the first Tuesday in February and August thereafter.
Level 2 Description

ICT Level 2 project awards range from $300,001 to $2 million for projects from a single institution or to $3 million for collaborative projects from two or more institutions or from research centers studying phenomena of broad potential impact. Level 2 projects have a maximum duration of five years. ICT Level 2 awards are intended to support design and development work or impact research. Projects at this scale and scope may be disciplinary, interdisciplinary or multi-disciplinary in nature and are intended to examine and/or incorporate broad communities of institutions, departments, or faculty.
Level 2 Description

ICT Level 2 projects are expected to demonstrate sufficient scale and scope to warrant support at this level. Prior work need not have been funded through the IUSE: EHR Program but should provide data and document expertise of the project team in support of project objectives. ICT Level 2 work is expected to contain robust research plans including either significant research questions or large-scale evaluation efforts, along with appropriate assessment efforts.
Level 2 Description

To determine suitability of a project for consideration as an ICT Level 2 effort, or for assistance in distinguishing between ICT Level 2 and ESL Level 3 projects (see above), proposers are encouraged to contact an NSF program officer prior to preparation and submission of a full proposal.

In FY 2020, the deadline for ICT Level 2 submissions is December 1, 2020. In subsequent years, the deadline for ESL Level 2 submissions is the first Tuesday in December.
Questions?
Program Expectations
<table>
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<th>IUSE: EHR Program Goals</th>
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<td>To build knowledge about STEM teaching and learning at the undergraduate level</td>
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<td>Develop novel, creative, and transformative approaches to undergraduate STEM teaching and learning</td>
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<tr>
<td>To incorporate evidence-based practices in STEM teaching and learning for all undergraduates</td>
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<tr>
<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>
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<tr>
<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
Questions?
Resources
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.
Questions?
THANK YOU for your interest in improving undergraduate STEM education!