Research on Education and Learning (REAL)

PROGRAM SOLICITATION
NSF 13-604

REPLACES DOCUMENT(S):
NSF 10-516, NSF 12-542, NSF 12-552

National Science Foundation

Directorate for Education & Human Resources
  Research on Learning in Formal and Informal Settings

Letter of Intent Due Date(s) *(optional)* (due by 5 p.m. proposer's local time)*:*

October 25, 2013

Full Proposal Deadline(s) (due by 5 p.m. proposer's local time):

January 10, 2014

IMPORTANT INFORMATION AND REVISION NOTES

Revision Summary

This solicitation has been revised to incorporate into the Other Information section a newly issued publication jointly developed by the National Science Foundation and the Institute of Education Sciences in the U.S. Department of Education entitled, *Common Guidelines for Education Research and Development*. The *Guidelines* describe six types of research studies that can generate evidence about how to increase student learning. Research types include those that generate the most fundamental understandings related to education and learning; examinations of associations between variables; iterative design and testing of strategies or interventions; and assessments of the impact of a fully-developed intervention on an education outcome. For each research type, there is a description of the purpose and the expected empirical and/or theoretical justifications, types of project outcomes, and quality of evidence.

The *Guidelines* publication can be found on the NSF website with the number NSF 13-126 (http://www.nsf.gov/pubs/2013/nsf13126/nsf13126.pdf). A set of FAQs regarding the *Guidelines* are available with the number NSF 13-127(http://www.nsf.gov/pubs/2013/nsf13127/nsf13127.pdf). Grant proposal writers and PIs are encouraged to familiarize themselves with both documents and use the information therein to help in the preparation of proposals to NSF.

Revision Summary

REAL represents the substantive foci of three previous EHR programs: Research and Evaluation on Education in Science and Engineering (REESE), Research in Disabilities Education (RDE), and Research on Gender in Science and Engineering (GSE). This solicitation replaces NSF 10-516, NSF 12-542, and NSF 12-552; details regarding integration and revision of each can be found in the body of this solicitation.

The first sentence of the Project Summary should indicate the project type (i.e., early, middle and late- stage empirical, synthesis, fostering interdisciplinary research in education (FIRE), or conference/workshop).

In part II, under Program Description, Elements of REAL Proposals, the solicitation provides additional detail on expectations for research design and methodology for all proposals to REAL.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

  Research on Education and Learning (REAL)

Synopsis of Program:

  The Research on Education and Learning (REAL) program represents the substantive foci of three previous EHR programs: Research and Evaluation on Education in Science and Engineering (REESE), Research in Disabilities Education (RDE), and Research on Gender in Science and Engineering (GSE). What is distinctive about the new REAL program is the emphasis placed on the accumulation of robust evidence to inform efforts to (a) understand, (b) build theory to explain, and (c) suggest interventions (and innovations) to address persistent challenges in STEM interest, education, learning, and participation. The program supports advances in research on STEM (science, technology, engineering, and mathematics) learning and education by fostering efforts to explore all

aspects of education research from foundational knowledge to improvements in STEM learning and learning contexts, both formal and informal, from childhood through adulthood, for all groups, and from the earliest developmental stages of life through participation in the workforce, resulting in increased public understanding of science and engineering. The REAL program will fund research on, human learning in STEM; learning in STEM learning environments, and broadening participation research.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Address questions to REAL program officers, telephone: (703)292-8650, email: DRLREAL@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 47.076 --- Education and Human Resources

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 45 to 52

new awards per year (across a mix of all research areas and including all types of awards).

Anticipated Funding Amount: $51,000,000

for new awards, pending the availability of funds.

Eligibility Information

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is optional. Please see the full text of this solicitation for further information.

- **Preliminary Proposal Submission:** Not Applicable

- **Full Proposals:**
    - Full Proposals submitted via FastLane: NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) Guidelines apply. The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg.
    - Full Proposals submitted via Grants.gov: NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov Guidelines apply (Note: The NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)

B. Budgetary Information

- **Cost Sharing Requirements:** Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:** Not Applicable

- **Other Budgetary Limitations:** Not Applicable

C. Due Dates

- **Letter of Intent Due Date(s)** *(optional)* (due by 5 p.m. proposer's local time)*:*

    October 25, 2013

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

    January 10, 2014

Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria apply.

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Standard NSF reporting requirements apply.

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I. INTRODUCTION

About the Education and Human Resources Directorate

The National Science Foundation (NSF) is charged with promoting the vitality of the nation's science, technology, engineering and mathematics (STEM) research and education enterprises. As part of this mission, the Directorate for Education and Human Resources (EHR) has primary responsibility for providing national, research-based leadership in STEM education. The mission of EHR is to advance excellence in U.S. STEM education at all levels and in all settings (both formal and informal) through the support of research and development and the preparation of a diverse workforce of scientists, technicians, engineers, mathematicians and educators. Within EHR's overall charge, the role of the Division of Research on Learning in Formal and Informal Settings (DRL) is to advance innovative and transformative research and development, and evaluation of learning and teaching in all STEM disciplines.

The Research on Education and Learning (REAL) program supports advances in research on STEM learning and education by fostering efforts to explore all aspects of education research resulting in foundational knowledge to improve STEM learning and learning contexts, both formal and informal, from childhood through adulthood, for all groups, and from the earliest developmental stages through participation in the workforce. The program represents the substantive foci of three previous EHR programs: Research and Evaluation on Education in Science and Engineering (REESE), Research in Disabilities Education (RDE), and Research on Gender in Science and Engineering (GSE). The new REAL program emphasizes the accumulation of robust evidence to inform efforts to (a) understand, (b) build theory to explain, and (c) suggest interventions to increase participation in STEM education, learning, and workforce participation.

II. PROGRAM DESCRIPTION

The research REAL supports advances the frontiers of understanding about how more people learn, and use more STEM, more effectively. To do this, REAL projects are grounded in theory, ask well formulated research questions, employ relevant data and analytic techniques, and contribute to the growing body of literature on STEM education. REAL projects focus on learning of STEM content and practices and bring together the expertise, literatures, methods and learning priorities of the entire range of scientific communities represented by the NSF research directorates as well as EHR. REAL also supports research on efforts to make that knowledge available to other researchers, education developers, leaders and practitioners so that research is used broadly to improve STEM education.

To achieve these goals, REAL funds research that:

- Addresses basic, foundational research questions about STEM learning and/or education using rigorous standards for theory, methods, and analysis. Such projects must be **deeply rooted in STEM content and knowledge building practices**.
- Develops innovative research methods, measures, and conceptual models to test theory, to measure existing or emerging phenomena that address critically important issues in STEM education.
- Investigates educational phenomena operating in and across learning environments to understand what works, for whom, why, and under what conditions, to inform future implementation possibilities and opportunities.
- Explores lessons that can be learned in context or through practice to enhance basic knowledge and theoretical findings. Such implementation research would answer theoretical questions while using real world contexts to gather data.

Research Areas

REAL research advances the frontiers of knowledge about STEM learning and participation across the following overlapping areas:

- **Research on Human Learning in STEM**. REAL seeks to provide the foundational knowledge necessary to improve and to advance STEM learning and education for all populations (including students of all ages, parents, and teachers), in all contexts (formal, informal and technological) across the life course. To this end REAL supports research combining theory, techniques, and perspectives from a wide range of disciplines and contexts. Proposals may address topics including, but not limited to: the neural bases of STEM learning, the cognitive bases of such learning (how people learn in and across STEM disciplines and settings); the affective dimensions of learning (what motivates and sustains learner interest in STEM and what fosters engagement and persistence); education policy and policy-relevant research grounded in the cognitive and social conditions of STEM learning; along with the development of methods, models and measures; and the use of new and existing datasets (including large-scale datasets).
- **Research on Learning in STEM Learning Environments**. REAL supports projects that investigate how learning in organizations (schools, classrooms museums, systems, work places, and technologies of any type) can make fundamental and far-reaching improvements in a range of learning outcomes. REAL research attends to the interfaces between teaching and learning and the mediation of STEM learning (see e.g., National Research Council, 2012d). To this end REAL supports research on: (1) the alignment of curriculum, instruction and assessment; (2) the development of diagnostic and performance assessments; and (3) design based iterative research around implementation of new models of teaching and learning.
- **Broadening Participation Research**. REAL supports the investigation of issues underlying the differential learning and participation of members of groups underrepresented in STEM fields. Underrepresented groups may include (but are not necessarily limited to) women and girls, people with disabilities, and/or underrepresented minorities, i.e., (e.g., African Americans, Hispanics, Native Americans, Native Alaskans, Native Hawaiians, and Pacific Islanders.), and students from rural or lower socio-economic backgrounds. REAL seeks to catalyze the knowledge building through research that informs the development of interventions to impact learning, persistence, and success in STEM for members of various groups under specific conditions and in specific contexts. Proposers must document the STEM disciplinary underrepresentation of the groups they wish to study and place the proposed work in the broader context of STEM education and workforce participation in the U.S. This effort is in collaboration with and complements similar research tracks in the various programs in the Division of Human Resource Development (HRD) in EHR and the Directorate for Social, Behavioral and Economic Science (SBE) as outlined in the Dear Colleague Letter "Stimulating Research Related to the Science of Broadening Participation" (NSF 13-020) (http://www.nsf.gov/pubs/2013/nsf13020/nsf13020.pdf).
    - **Research in Disabilities Education**. The **Research in Disabilities Education (RDE)** track supports fundamental and implementation research about learners (of all ages) with disabilities in STEM. This track encourages efforts to understand and address disability-based differences in STEM education and workforce participation. Fundamental research projects typically address areas such as stereotype threat, an individual's identity (e.g. STEM and disability identity), underlying attention and physical barriers that impact STEM learning, and the societal and organizational characteristics that influence learning and educational pathways. Implementation research projects typically address such areas as inclusive educational practices, universally designed STEM curricula, assistive technology, and supportive learning and/or educational environments. Implementation projects are expected to be experimental and/or quasi-experimental studies. Projects must employ evidence-based educational exemplars, have a strong theoretical base, and be justified by relevant educational, disability, and social science research.
    - **Research on Gender in Science and Engineering**. The Research on Gender in Science and Engineering (GSE) track supports efforts to understand and address gender-based differences in STEM education and workforce participation through education and implementation research that will lead to a larger and more diverse domestic STEM workforce. Typical projects will contribute to the knowledge base addressing gender-related differences in learning and in the educational experiences that affect student interest, performance, and choice of careers; how pedagogical approaches and teaching styles, curriculum, student services, and institutional culture contribute to causing or closing gender gaps that persist in certain fields.

The Fostering Interdisciplinary Research in Education Program (FIRE) is an eligible proposal type for investigators particularly interested in collaboration and in growing their interdisciplinary research skills. It is described in more detail later in this solicitation.

- **Special Emphases (fiscal 2014)**: Within the three research areas described above (human learning of STEM content; learning in STEM learning environments; and broadening participation research), in FY2014 the program also calls for proposals in the following three areas:
    - Research on advancing the assessment of STEM learning and 21st century STEM skills (cognitive, intrapersonal and interpersonal) and teacher practices to support that learning (NRC, 2012 a & b).
    - Research on STEM learning for undergraduates to advance current knowledge by leveraging insights from DUE programs and the Discipline-Based Education Research (DBER) agenda (NRC, 2012c).
    - Research on the use and impact of technology on STEM learning. Innovative learning systems research (ILSR) explores opportunities for promoting and assessing learning made possible by new technologies, ways to help learners capitalize on those opportunities, and ways of using technology to promote deep and lasting learning of content, practices, skills, attitudes, and/or dispositions needed for engaged and productive citizenship. This effort complements other research and development occurring in the Directorates for Computer and Information Science and Engineering (CISE), Social, Behavioral and Economic Sciences (SBE), and other EHR programs, including the *Cyberlearning: Transforming Education* program.

Elements of REAL Proposals

High quality REAL proposals should address the following elements:

- **Linkages to theory and extant research in the field**: All research proposals should be located in a body of literature to which a contribution would be made. They should identify the disciplinary (or interdisciplinary) and conceptual

framework for the study. They should include a discussion of the theory or theories grounding the research or the concepts or framework of interest. The program will allow descriptive studies of phenomena that could lead to the development of a theory or model or that contribute to theory.

- **Research plan**: Proposals should include research questions and/or testable hypotheses that reflect the current state of knowledge in the area and the theory or conceptual framework being used. The proposal should discuss in detail the methods used to answer the research questions and/or test the hypotheses posed, along with the types of data to be collected and methods for data collection. Methods should directly link to the theory or theories being used. If a population sample is used, this should be described along with the rationale for sample selection, and the investigator's access to the sample. The proposal should address whether the design is premised on special needs and interests due to educational level, gender, race, ethnicity, economic status, or disability, and to what extent data will be disaggregated for multiple characteristics.
- **Contributions to implementation (where applicable):** Proposals to conduct research on implementation should highlight implications for subsequent enactments of the intervention paying particular attention to subjects, measures, application of the treatment and settings.
- **Contributions to knowledge**: Proposals should include a coherent and persuasive chain of reasoning that shows how the research claims will be warranted and how the results have the potential to add new insights to the conceptual and/or methodological knowledge bases.
- **Communication strategy**: Proposals should include a strategy for reaching a broad audience for the findings of the project including, where appropriate, scholars, practitioners, and public audiences. The potential results of the proposed research are expected to be of sufficient significance to merit peer-review and broader publication. (For additional information on dissemination and communication see the resources available from the American Association for the Advancement of Science's Center for Public Engagement with Science & Technology; and the Dissemination and Communication Resources available from the Center for Advancing Research & Communication.)
- **Data management plan**: Consistent with REAL's interest in supporting secondary analyses of extant data, projects proposing original data collection are required to plan to archive and provide access to relevant data and supporting materials where feasible and consistent with data protection policies and procedures. (For additional information on NSF Data Sharing Policy and Data Management Plan Requirements see the Dissemination and Sharing of Research Results.)
- **Objective external feedback**: Proposals should include a strategy for ongoing objective external feedback using benchmarks, indicators, logic models, roadmaps or other evaluative methods to document progress toward goals, objectives and outcomes defined in the proposal. All projects are expected to track and report their accomplishment of proposal targets for broader impacts and intellectual merit. This objective external feedback can be provided through a number of vehicles: the advisory board, or through a formal evaluation. A plan for such soliciting objective external feedback should be documented in the proposal.

Eligible Proposal Types

REAL supports a wide range of research activities. The bulk of the portfolio is comprised of empirical investigations that address basic, fundamental research questions with direct and immediate, or indirect and long-term implications for STEM learning and education improvement. This includes projects that: (1) explore lessons that can be learned in context or through practice to enhance basic knowledge and theoretical findings; (2) investigate educational phenomena operating in and across learning environments to understand what works, for whom, why, and under what conditions, to inform future implementation possibilities and opportunities; (3) leverage theories of organization, institutional change, and leadership in analyzing factors which support and constrain implementation that achieves intended change in STEM learning outcomes; and (4) generate knowledge about human, social, and/or institutional capacity to enhance STEM learning and workforce participation. REAL seeks to fund both empirical research that involves the collection of new data, and secondary analyses that leverage extant state, national, international or other databases. Substantively, these research projects may fall within or cut across any of the Research Areas described above. In addition, REAL supports research to develop innovative research methods, metrics, and conceptual models to measure existing and emerging phenomena, and test theory that informs core scientific questions about STEM education and learning. Three levels of funding and durations are available to support these investigations: (1) **Early Stage Research** proposals have a maximum total award size of $500,000 and a maximum duration of 3 years; (2) **Middle Stage Research** proposals have a maximum total award size of $1,500,000 and a maximum duration of 3 years; (3) **Later Stage Research** proposals have a maximum total award size of $2,500,000 and a maximum duration of 5 years. The stages refer to the maturity of the proposed work, the size and scope of the empirical effort, as well as the capacity of the interdisciplinary team to conduct the proposed research.

As noted above, a hallmark of the REAL portfolio is the multidisciplinary nature of the research REAL supports. In addition to supporting projects rooted in a broad array of scientific literatures, REAL seeks to foster interdisciplinary approaches within individual projects. To this end, REAL invites **Fostering Interdisciplinary Research in Education (FIRE)** proposals for projects that facilitate scholars crossing disciplinary boundaries to acquire the skills and knowledge that would improve their abilities to conduct rigorous research on STEM learning and education. FIRE proposals must: (1) have both a research and a professional development component; and (2) include one individual who will serve as the mentor and one individual who will be mentored. (There is no restriction about whether the mentor is designated as the PI and the mentee as the co-PI, or vice versa, except as allowed by the submitting organization; other personnel and co-PIs are also allowed.) Awards are open to investigators who have received a doctoral degree in a disciplinary STEM field outside of education proper and wish to pursue research in learning and education, or who have received a doctoral degree from an educational research program and wish to complement their expertise with training in a disciplinary STEM field outside of education. For the purposes of evaluating FIRE proposals, REAL defines non-education STEM fields as those communities largely represented by a program at NSF in the directorates of Biological Sciences (BIO), Computer and Information Sciences and Engineering (CISE), Engineering (ENG), Geosciences (GEO), Mathematics and Physical Sciences (MPS), or Social, Behavioral and Economic Sciences (SBE), or the Office of Polar Programs (OPP). The maximum award size for FIRE projects is $500,000, with duration of 3 years.

REAL also supports a small number of synthesis projects and conferences and workshops related to the goals of the program. **Synthesis** proposals seek support for the synthesis and/or meta-analysis of existing knowledge on a topic of critical importance to STEM learning and/or education, or for the diffusion of research-based knowledge. Investigators are permitted to propose workshops and other meetings as one of the means of completing the syntheses and diffusing the research-based knowledge that is developed. Additional emphasis will be placed on the proposed dissemination plan. Maximum award size for Synthesis proposals is $300,000 (total) for duration of up to two years. **Conference and Workshop** proposals seek support to conduct well-focused conferences or workshops related to the goals of the program. Budgets are expected to be commensurate with the duration of the event and the number of participants. Proposals should include a conceptual framework for the conference, draft agenda, possible participant list, and the outcomes or products that will result. Conference and workshop proposals are evaluated on an ad hoc basis and so may be submitted at any time (not only to the competition deadline), generally at least one year in advance of when the event would be held. Investigators are encouraged to contact a Program Officer prior to submission. Typical costs are $25,000 to $75,000. Please see the NSF Grant Proposal Guide (GPG Section II. D.) for additional information about conference and workshop proposals.

References

National Research Council. (2012a). *Education for life and work: Developing transferable knowledge and skills in the 21st century.* Committee on Defining Deeper Learning and 21st Century Skills, J.W. Pellegrino and M.L. Hilton, Editors. Board on Testing and

Assessment and Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

National Research Council. (2012b). *A framework for K-12 science education practices, crosscutting concepts, and core ideas*. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

National Research Council. (2012c). *Discipline-based education research: Understanding and improving learning in undergraduate science and engineering*. Committee on the Status, Contributions, and Future Directions of Discipline-Based Education Research. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

National Research Council (2012d). *Monitoring progress toward successful K-12 STEM education: A nation advancing?* Committee on the Evaluation Framework for Successful K-12 STEM Education. Board on Science Education and Board on Testing and Assessment, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.

III. AWARD INFORMATION

NSF expects to make standard or continuing grant awards. Pending the availability of funds, the estimated number of awards will be 64 new awards in FY 2014. Approximately 10 Early Stage Research, 20 Middle Stage Research, 8 Later Stage Research, 10 Synthesis, 6 FIRE, and 10 Conference and Workshop awards will be funded. The anticipated funding available for new awards in FY 2014 for REAL is $51,000,000. The maximum award amount for Early Stage Research projects is $500,000, with duration of up to three years. The maximum award amount for Middle Stage Research projects is $1,500,000, with duration of up to three years. The maximum award amount for Later Stage Research projects is $2,500,000, with duration of up to five years. The maximum award amount for Synthesis projects is $300,000, with duration of up to two years. The maximum award amount for FIRE projects is $500,000, with duration of up to three years. The maximum award amount for Conferences and Workshops is $75,000.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the Grant Proposal Guide, Chapter I, Section E.

Who May Serve as PI:

There are no restrictions or limits.

Limit on Number of Proposals per Organization:

There are no restrictions or limits.

Limit on Number of Proposals per PI or Co-PI:

There are no restrictions or limits.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent *(optional):*

A Letter of Intent (LOI) is **optional**. LOIs are due on or before the October 25, 2013. The LOI must contain (1) a proposed title; (2) the names of Principal Investigators and Co-Principal Investigators, including organizational affiliations and departments; (3) a list of the partnering institutions; (4) a brief synopsis (limited to 250 words) describing the proposed project in sufficient detail to permit selection of reviewers. LOIs will not be used to encourage or discourage the submission of full proposals. They will be used only to help NSF plan for the merit review process, and they are nonbinding. Thus, changes may be made between the submission of the LOI and submission of the full proposal.

Letter of Intent Preparation Instructions:

When submitting a Letter of Intent through FastLane in response to this Program Solicitation please note the conditions outlined below:

- Sponsored Projects Office (SPO) Submission is not required when submitting Letters of Intent
- Submission of multiple Letters of Intent is not allowed

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-

mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.4 of the Grant Proposal Guide provides additional information on collaborative proposals.

Important Proposal Preparation Information: FastLane will check for required sections of the full proposal, in accordance with *Grant Proposal Guide* (GPG) instructions described in Chapter II.C.2. The GPG requires submission of: Project Summary; Project Description; References Cited; Biographical Sketch(es); Budget; Budget Justification; Current and Pending Support; Facilities, Equipment & Other Resources; Data Management Plan; and Postdoctoral Mentoring Plan, if applicable. If a required section is missing, **FastLane will not accept the proposal.**

Please note that the proposal preparation instructions provided in this program solicitation may deviate from the GPG instructions. If the solicitation instructions do not require a GPG-required section to be included in the proposal, insert text or upload a document in that section of the proposal that states, "Not Applicable for this Program Solicitation." Doing so will enable FastLane to accept your proposal.

Please note that per guidance in the GPG, the Project Description must contain, as a separate section within the narrative, a discussion of the broader impacts of the proposed activities. Unless otherwise specified in this solicitation, you can decide where to include this section within the Project Description.

B. Budgetary Information

Cost Sharing: Inclusion of voluntary committed cost sharing is prohibited

Budget Preparation Instructions:

The budget must include funds to support travel to annual PI meetings

C. Due Dates

- **Letter of Intent Due Date(s)** *(optional)* (due by 5 p.m. proposer's local time)*:*

    October 25, 2013

- **Full Proposal Deadline(s)** (due by 5 p.m. proposer's local time):

    January 10, 2014

D. FastLane/Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: https://www.fastlane.nsf.gov/a1/newstan.htm. For FastLane user support, call the FastLane Help Desk at 1-800-673-6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: http://www.grants.gov/web/grants/applicants.html. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in the GPG as Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: http://nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Empowering the Nation Through Discovery and Innovation: NSF Strategic Plan for Fiscal Years (FY) 2011-2016*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the core strategies in support of NSF's mission is to foster integration of research and education through the programs, projects and activities it supports at academic and research institutions. These institutions provide abundant opportunities where individuals may concurrently assume responsibilities as researchers, educators, and students, and where all can engage in joint efforts that infuse education with the excitement of discovery and enrich research through the variety of learning perspectives.

Another core strategy in support of NSF's mission is broadening opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- 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. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **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. Therefore, proposers must fully address both criteria. (GPG Chapter II.C.2.d.i. contains additional information for use by proposers in development of the Project Description section of the proposal.) Reviewers are strongly encouraged to review the criteria, including GPG Chapter II.C.2.d.i., prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply

both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
   a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
   b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. 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?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

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. NSF values the advancement of scientific knowledge and activities that contribute to 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 United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Ad hoc Review and/or Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will be completed and submitted by each reviewer. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer at least 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). Within 90 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the NSF *Award & Administration Guide* (AAG) Chapter II, available electronically on the NSF Website at http://www.nsf.gov/publications/pub_summ.jsp?ods_key=aag.

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Address questions to REAL program officers, telephone: (703)292-8650, email: DRLREAL@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

Contact cognizant Program Officers at DRLREESE@nsf.gov.

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on NSF's website at https://public.govdelivery.com/accounts/USNSF/subscriber/new?topic_id=USNSF_179.

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this new mechanism. Further information on Grants.gov may be obtained at http://www.grants.gov.

The National Science Foundation and the Institute of Education Sciences in the U.S. Department of Education developed *Common Guidelines for Education Research and Development*. The *Guidelines* describe six types of research studies that can generate evidence about how to increase student learning. Research types include those that generate the most fundamental understandings related to education and learning; examinations of associations between variables; iterative design and testing of strategies or interventions; and assessments of the impact of a fully-developed intervention on an education outcome. For each research type, there is a description of the purpose and the expected empirical and/or theoretical justifications, types of project outcomes, and quality of evidence.

The *Guidelines* publication can be found on the NSF website with the number NSF 13-126 (http://www.nsf.gov/pubs/2013/nsf13126/nsf13126.pdf). A set of FAQs regarding the *Guidelines* are available with the number NSF 13-127(http://www.nsf.gov/pubs/2013/nsf13127/nsf13127.pdf). Grant proposal writers and PIs are

encouraged to familiarize themselves with both documents and use the information therein to help in the preparation of proposals to NSF.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

> The National Science Foundation promotes and advances scientific progress in the United States by competitively awarding grants and cooperative agreements for research and education in the sciences, mathematics, and engineering.
>
> To get the latest information about program deadlines, to download copies of NSF publications, and to access abstracts of awards, visit the NSF Website at http://www.nsf.gov
>
> - **Location:** 4201 Wilson Blvd. Arlington, VA 22230
>
> - **For General Information** (NSF Information Center)**:** (703) 292-5111
>
> - **TDD (for the hearing-impaired):** (703) 292-5090
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> - **To Order Publications or Forms:**
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>   Send an e-mail to: nsfpubs@nsf.gov
>
>   or telephone: (703) 292-7827
>
> - **To Locate NSF Employees:** (703) 292-5111

PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, NSF-50, "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and NSF-51, "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton

Reports Clearance Officer
Office of the General Counsel
National Science Foundation
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