

Course, Curriculum, and Laboratory Improvement (CCLI) -- Transforming Undergraduate Education in Science, Technology, Engineering and Mathematics

PROGRAM SOLICITATION NSF 09-529

REPLACES DOCUMENT(S):
NSF 08-546



National Science Foundation

Directorate for Education & Human Resources
Division of Undergraduate Education

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

May 21, 2009

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 22, 2009

For Type 1 proposals from submitting organizations located in states or territories beginning with N through W.

January 13, 2010

For Type 2 and 3 proposals and for CCLI Central Resource Project proposals. However, CCLI Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

REVISION NOTES

The following items are major revisions to the previous program solicitation:

The Introduction and the Description of Project Components have been revised to reflect the Program's increased emphasis on projects that build on the current understanding of how people learn and to encourage submission of proposals that have the potential to transform undergraduate STEM education.

The description of the project types has been revised. Phase 1, 2, and 3 projects are now designated as Type 1, 2, and 3 and the budget limits and project durations have been changed. A fourth project type, the CCLI Central Resource Project, has been added.

Please be advised that the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) includes revised guidelines to implement the mentoring provisions of the America COMPETES Act (ACA) (Pub. L. No. 110-69, Aug. 9, 2007.) As specified in the ACA, each proposal that requests funding to support postdoctoral researchers must include a description of the mentoring activities that will be provided for such individuals. Proposals that do not comply with this requirement will be returned without review (see the PAPP Guide Part I: *Grant Proposal Guide* Chapter II for further information about the implementation of this new requirement).

As announced on May 21, 2009, proposers must prepare and submit proposals to the National Science Foundation (NSF) using the NSF FastLane system at <http://www.fastlane.nsf.gov/>. This approach is being taken to support efficient Grants.gov operations during this busy workload period and in response to OMB direction guidance issued March 9, 2009. NSF will continue to post information about available funding opportunities to Grants.gov FIND and will continue to collaborate with institutions who have invested in system-to-system submission functionality as their preferred proposal submission method. NSF remains committed to the long-standing goal of streamlined grants processing and plans to provide a web services interface for those institutions that want to use their existing grants management systems to directly submit proposals to NSF.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Course, Curriculum, and Laboratory Improvement (CCLI)

Synopsis of Program:

The Course, Curriculum, and Laboratory Improvement (CCLI) program seeks to improve the quality of science, technology, engineering, and mathematics (STEM) education for all undergraduate students. It especially welcomes proposals that have the potential to transform undergraduate education in science, technology, engineering, and mathematics (STEM) for all students. The program supports efforts to create, adapt, and disseminate new learning materials and teaching strategies to reflect advances both in STEM disciplines and in what is known about teaching and learning. It funds projects that develop faculty expertise, implement educational innovations, assess learning and evaluate innovations, prepare K-12 teachers, or conduct research on STEM teaching and learning. It also supports projects that further the work of the program itself, for example, synthesis and dissemination of findings across the program. The program supports projects representing different stages of development, ranging from small, exploratory investigations to large, comprehensive projects.

Cognizant Program Officer(s):

- Russell Pimmel, Lead Program Director, telephone: (703) 292-4618, email: rpimmel@nsf.gov
- Myles Boylan, Lead Program Director, telephone: (703) 292-4617, email: mboylan@nsf.gov
- Terry Woodin, Lead Program Director, telephone: (703) 292-4657, email: twoodin@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 or Cooperative Agreement

Estimated Number of Awards: 94 to 108 including 70 to 75 Type 1 awards, 20 to 25 Type 2 awards, 3 to 5 Type 3 awards and 1 to 3 CCLI Central Resource Project awards

Anticipated Funding Amount: \$35,800,000 in FY 2010 for new and ongoing awards, pending availability of funding.

Eligibility Information

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not Applicable
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposal Preparation Instructions:** This solicitation contains information that supplements the standard NSF Proposal and Award Policies and Procedures Guide, Part I: Grant Proposal Guide (GPG) proposal preparation guidelines. Please see the full text of this solicitation for further information

B. Budgetary Information

- **Cost Sharing Requirements:** Cost Sharing is not required under this solicitation.
- **Indirect Cost (F&A) Limitations:** Not Applicable
- **Other Budgetary Limitations:** Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

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

May 21, 2009

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Proposal Review Information Criteria

Merit Review Criteria: National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions: Standard NSF award conditions apply.

Reporting Requirements: Additional reporting requirements apply. Please see the full text of this solicitation for further information.

TABLE OF CONTENTS

Summary of Program Requirements

- I. [Introduction](#)
- II. [Program Description](#)
- III. [Award Information](#)
- IV. [Eligibility Information](#)
- V. [Proposal Preparation and Submission Instructions](#)
 - A. [Proposal Preparation Instructions](#)
 - B. [Budgetary Information](#)
 - C. [Due Dates](#)
 - D. [FastLane Requirements](#)
- VI. [NSF Proposal Processing and Review Procedures](#)
 - A. [NSF Merit Review Criteria](#)
 - B. [Review and Selection Process](#)
- VII. [Award Administration Information](#)
 - A. [Notification of the Award](#)
 - B. [Award Conditions](#)
 - C. [Reporting Requirements](#)
- VIII. [Agency Contacts](#)
- IX. [Other Information](#)

I. INTRODUCTION

The vision of the CCLI program is excellent STEM education for all undergraduate students. To achieve this vision, the program supports efforts that bring advances in STEM disciplinary knowledge into the undergraduate experience. It also supports the creation and adaptation of learning materials and teaching strategies that embody what we know about how students learn. It encourages projects that develop faculty expertise, promote widespread implementation of educational innovations, and prepare future K-12 teachers. The program supports projects that enhance our understanding of how students learn STEM topics and how faculty adopt instructional approaches. It invites projects that build capacity to assess learning and evaluate educational innovations. It also supports projects that further the work of the program itself, for example, synthesis and dissemination of findings across the program. This solicitation especially encourages projects that have the potential to transform the conduct of undergraduate STEM education, for example, by bringing about widespread adoption of classroom practices that embody understanding of how students learn most effectively. Projects that explore cyberlearning, specifically learning with cyberinfrastructure tools such as networked computing and communications technologies, are of special interest. The program supports projects at all scales and stages of development, ranging from small, exploratory investigations to large, comprehensive projects as described in Section II-C.

The goals of this program reflect national concerns about producing skilled STEM professionals (including K-12 teachers) and citizens knowledgeable about STEM and how it relates to their lives. The program seeks to build on the community of faculty committed to improving undergraduate STEM education. A representative list of resources that describe effective teaching practices, literature about learning, and information about ongoing projects are listed in Section II-D.

II. PROGRAM DESCRIPTION

A. PROJECT COMPONENTS

All proposals must contribute to the development of exemplary undergraduate STEM education. Typically projects include one or more of the components described below and they build on prior knowledge, both in the STEM fields and in undergraduate education. In addition, CCLI welcomes proposals describing untested, forward-looking, and unconventional activities that could have a high impact and contribute to transforming undergraduate STEM education. Prospective principal investigators for this kind of project should discuss their ideas with a CCLI Program Officer in advance of proposal submission to help gauge the appropriate scope and scale of the proposal.

Creating Learning Materials and Strategies: Projects developing new learning materials and strategies for improving courses, curriculum, and laboratories should be guided by research on teaching and learning and should incorporate and be inspired by advances within the disciplines. Instrumentation and equipment requests are appropriate but must be based on their impact on student learning. Early stage projects typically carry the development of materials, and assessment of learning, to the stage where judgments can be made about whether further investment in the new materials or approaches is justified. Later stage projects should yield evaluation results sufficiently conclusive and descriptive so that successful products and processes can be adopted, distributed widely or, when appropriate, commercialized.

Implementing New Instructional Strategies: To ensure their broad based adoption, successful instructional strategies should be widely practiced. Therefore, CCLI welcomes proposals to change undergraduate STEM courses, curricula and laboratories by implementing strategies to reflect proven or promising pedagogical techniques in ways that encourage widespread adoption. These strategies may come from previous CCLI projects or from other sources in the STEM community. Instrumentation and equipment requests are appropriate in implementation projects, based on their impact on student learning, and provided a convincing case is made that the planned acquisition contributes to understanding how to achieve widespread adoption of the approach they support. Implementation projects should contribute to the community's understanding about how new strategies are transferred to diverse settings and about how they impact student learning. Evaluation plans for implementation projects should explore the challenges and opportunities for adapting new strategies in diverse educational settings. Projects that specifically address the challenges to achieving widespread adoption of proven practice are especially welcome.

Developing Faculty Expertise: Using new learning materials and teaching strategies often requires faculty to acquire new knowledge and skills in order to revise their curricula and teaching practices. Projects focused on developing faculty expertise can range from short-term workshops to sustained activities. They should include evaluation efforts to describe the impact on the faculty participants, and in large, later stage projects, on student learning in classes taught by these faculty. Projects should provide professional development for a diverse group of faculty so that new materials and teaching strategies can be widely implemented.

Assessing and Evaluating Student Achievement: Proposals for designing processes and instruments to measure the effectiveness of new materials and instructional methods are responsive to this solicitation. Some projects may develop and disseminate valid and reliable tests of STEM knowledge; other projects may collect, synthesize, and interpret information about student understanding, reasoning, practical skills, interests, attitudes or other valued outcomes. Projects that apply new and existing processes and instruments to conduct broad-based evaluations of educational programs or practices are appropriate if they span multiple institutions and are of general interest. In discussing these aspects of curricular change, projects should carefully document institutional demographics and characteristics. Projects using established instruments and strategies and likely to have only a local impact are discouraged.

Conducting Research on Undergraduate STEM Education: Results from assessments of learning and teaching as well as from projects emphasizing other programmatic components provide a foundation for developing new and revised models of how undergraduate STEM students learn. Research to explore how effective teaching strategies and curricula enhance learning and attitudes, how widespread practices have diffused through the community, and how faculty and programs implement changes in their curriculum are appropriate. Research results should provide a foundation for creating learning materials, teaching strategies, faculty development approaches, and evaluation methodologies that have the potential for a direct impact on STEM educational practices.

B. IMPORTANT PROJECT FEATURES

Although projects may vary considerably in the approaches they take, the number of academic institutions involved, the number of faculty and students that participate, and in their stage of development, all promising projects share certain characteristics.

Quality, Relevance, and Impact: Projects should address a recognized need or opportunity, clearly indicate how they will meet this need, and be innovative in their production and use of new materials, processes, and ideas, or in their implementation of tested ones.

Student Focus: Projects should have a clear relation to student learning, with definite links between project activities and improvements in STEM learning. Moreover, they should involve approaches that are consistent with the nature of today's students, reflect the student's perspective and, when appropriate, solicit student input in the design of the project.

Use of and Contribution to Knowledge about STEM Education: Projects should reflect high quality science, technology, engineering, and mathematics. They should have a clear and compelling rationale, use methods derived from existing knowledge concerning undergraduate STEM education, and build on existing projects of a similar nature. They also should have an effective approach for adding to this knowledge by disseminating their results.

STEM Education Community-Building: Investigators should expect to interact with others in the STEM education community, to enable sharing of knowledge and experience in developing and evaluating STEM educational innovation. These interactions may range from informal contacts with a few colleagues to the establishment of a formal body of scholars. Collaborating networks may involve investigators working on similar or related approaches

in the proposer's discipline or in other STEM disciplines and may also include experts in evaluation, educational psychology or other related fields. Central Resource Projects will have significant responsibility for facilitating the development of this community.

Sustainability: The purpose of the CCLI program is to bring about lasting improvement in undergraduate STEM education. Proposals should address sustainability and should demonstrate that there is a reasonable expectation of persistent effects of the grant funded work consistent with the aims of the project.

Expected Measurable Outcomes: Projects should have goals that have been translated into a set of expected measurable outcomes that can be monitored using quantitative or qualitative approaches or both. These outcomes should be used to track progress, guide the project, and evaluate its impact. Expected measurable outcomes should pay particular attention to student learning, contributions to our understanding of STEM learning, and community building.

Project Evaluation: All projects, regardless of the scope or main program component they address, should have an evaluation plan that includes both a strategy for monitoring the project as it evolves to provide feedback to guide these efforts (formative evaluation) and a strategy for evaluating the effectiveness of the project in achieving its goals and for identifying positive and negative findings when the project is completed (summative evaluation). The complexity of the evaluation will depend on the project, and these efforts should be led by knowledgeable individuals who look objectively at the project's progress and outcomes.

C. PROJECT TYPES: SCALE, SCOPE, STAGE, AND SUSTAINABILITY

The program is accepting proposals under this solicitation for awards at three levels of support, designated Type 1, Type 2, and Type 3, as well as for awards for projects that support the work of the program itself. The types reflect a combination of the scale, scope, and stage of the proposed work. The scale of the work refers to the number of institutions, faculty, and students with whom the work engages. Scope refers to the range of project components involved. Stage refers to the place of the work along a continuum from early conceptual development through deployment of mature, well-tested approaches. Type 2 and 3 projects will typically reflect greater dependence on previous work, supported by the CCLI program or by other sources, and may be at a more mature stage of development than Type 1 projects. However, the Types are independent, and the choice should be made based on the resources required to achieve the desired outcomes. In every case there should be the potential for lasting improvement in the quality of instruction.

The descriptions of the types below, and the examples that follow, are intended as guidelines, not prescriptions. Projects that seek to operate at the higher budgetary scales will be held to a high standard of potential for having an impact at large scale. Similarly, projects at any scale that are based on already demonstrated approaches will be held to a high standard with respect to sustainability, that is, their potential to bring about lasting change.

Type 1 Projects: Total budget up to \$200,000 (\$250,000 when four-year colleges and universities collaborate with two-year colleges) for 2 to 3 years.

Results from Type 1 projects are expected to be significant enough to contribute to understanding undergraduate STEM education. Proposed evaluation efforts should be informative with respect to student learning or engagement, based on the project's specific expected outcomes, and consistent with budget limitations and the scope of a Type 1 project. In order to encourage collaboration between four-year colleges and universities and two-year colleges, projects involving such collaboration may request a total of \$250,000. In such partnerships, the distribution of effort and funds between the four-year institution and the community college should reflect a genuine collaboration.

Examples of Type 1 Projects (suggest the scope of a Type 1 project as well as possible topics)

- A project that develops materials that use a new instructional approach based on the current understanding of how students learn, or introduces content from current research into an existing course.
- A project that integrates new instrumentation or equipment into undergraduate laboratories or field work in a way that demonstrably improves student learning.
- A collaborative project between faculty from two-year and four-year schools that develops a model to provide the needed courses for a seamless transfer in an efficient way.
- A pilot project that explores the practical aspects of using remote laboratories or instruction among several institutions.
- A pilot project that integrates current science and pedagogy into the teacher preparation curriculum.
- A pilot study to explore Internet-based approaches for faculty professional development.
- A project that develops an instrument to assess students' knowledge in a particular area, their abilities with certain processes, or their attitude about some aspect of STEM.
- A pilot study to begin understanding how various factors affect how students learn particular content or skills.

Type 2 Projects: Total budget up to \$600,000 for 2 to 4 years.

Type 2 projects will typically address more than one program component, or, if they focus on a single component, will address it at a scale that goes well beyond a single institution. Projects that involve a single institution need to be working toward systemic change across the STEM disciplines. Projects that continue from previous work should include an explicit discussion of the results and impact produced by that work. Type 2 projects should carry the development to a state in which the evaluations of the projects have evidence to support the claim that the projects' efforts are effective. In turn the evaluation results can inform further use, such as in distributing the project widely or seeking commercialization. At a minimum, the implementation, if successful, should be institutionalized at the participating colleges and universities.

Examples of Type 2 Projects

- A project that develops material for a sequence of courses that vertically integrates a conceptual or pedagogical approach at several institutions.
- A project involving several diverse partnerships between community colleges and four-year schools to develop robust models for providing community college courses needed for a true two-plus-two transfer program.
- A project that uses faculty professional development as a part of a widespread beta-testing effort with faculty in several diverse institutions in order to disseminate proven, innovative instructional material or approaches.
- A project that converts an effective, in-person faculty professional development approach to an Internet-

- based or blended approach in order to improve accessibility and sustainability.
- A project involving several diverse institutions that uses an existing instrument to assess students' knowledge in a particular area or their abilities with certain processes.
- A study involving several diverse institutions to identify what factors and characteristics effect how faculty members and departments adopt innovative approaches.

Type 3 Projects: Budget negotiable, but not to exceed \$5,000,000 over 5 years.

Type 3 projects are intended to support large scale efforts. Projects that continue from previous work should include an explicit discussion of the results and impact produced by that work. Proposals for projects that are designed to break new ground at a large scale should discuss evidence that supports the validity of the approach, and must reflect current understanding of how students learn. Type 3 proposals should include a description of evaluation activities that are focused on impact on student learning in a broad spectrum of the population served by the project. Evaluation plans for Type 3 projects should include efforts to describe the impact of the work on the prevailing models of undergraduate STEM education and to include strategies that assist in the implementation of the project's activities in new contexts.

Examples of Type 3 Projects

- A project that involves a regional or national effort to disseminate proven materials or pedagogies.
- A project that develops a self-sustaining model for faculty professional development that introduces new faculty to a field or provides retraining for experienced faculty.
- A national or regional level project involving a wide range of diverse institutions that uses an existing assessment instrument to develop a database on students' knowledge in a particular area or their abilities with certain processes.
- A study involving a broad range of diverse institutions that explores how various factors affect how students learn particular content or skills.
- A study involving a broad range of diverse institutions that systematically compares the efficacy and efficiency of several instructional methodologies such as hands-on, remote, and virtual laboratories.

CCLI Central Resource Projects: Budget negotiable, depending on the scope and scale of the activity.

CCLI Central Resource projects assume responsibility for leadership and implementation of activities that sustain a community of practice engaged in transforming undergraduate STEM education. CCLI Central Resource projects will work to increase the capabilities of and communications among the STEM education community and to increase and document the impact of CCLI projects. Since CCLI Central Resource projects will work with the CCLI program in order to accomplish these goals, they may be supported either as cooperative agreements or as grant awards. The duration of awards will be up to five years. Annual budgets will depend on the scope and scale of the work proposed. CCLI Central Resource projects that work across the disciplines, and at a national scale, are encouraged. Activities will typically be focused particularly on CCLI grantees, but possibly more broadly as well, especially in efforts to include other broad communities of NSF grantees.

Examples of Central Resource Projects

- Projects that organize and implement meetings of the Principal Investigators, including large scale meetings of all grantees or smaller meetings of interest groups within the program. This activity should include publication of findings from meetings.
- Projects that conduct targeted research or evaluation studies in undergraduate STEM education addressed by CCLI projects, the impact of CCLI supported activities or a subset of awards, or its predecessor programs. Proposals should state questions to be addressed, describe study design and methodology, and draw on relevant literature.
- Projects that develop an approach for describing or characterizing the portfolio of CCLI and its predecessor programs. Proposals should describe strategies for organizing the characterization, for collecting the information, and for reporting and presenting the results. Proposals applying new techniques for presenting large data sets (quantitative and qualitative) are encouraged.
- Projects that provide leadership and implementation in seeing to it that development of the CCLI community of practice is supported by current cyber tools for communication and collection of resources. Systems should integrate with the National STEM Distributed Learning (NSDL) resources as described in section V-A. A project devoted to this goal may utilize NSDL resources by establishing effective interchanges between CCLI awardees and the existing NSDL pathways projects, or it may establish a separate entity with connection to the NSDL resources.
- Projects that provide workshops that increase potential and current PIs' understanding of various topics such as conducting project evaluations, broadening participation, utilizing cyberinfrastructure, and incorporating engaging pedagogies.

D. SOME RESOURCES FOR PROPOSAL PREPARATION AND PROJECT DESIGN

NSF Resources

- NSF's Quick Search tool allows you to perform full-text searches on the award records, including abstracts, in NSF's database.
<http://www.nsf.gov/awardsearch/index.jsp>
- NSF's Fielded Search tool allows you to restrict your search criteria to specific fields in the database, and to use date and numeric ranges. To restrict your search to programs in a specific division: In the "NSF Organization" field, select that division. To restrict your search to a particular program: In the "NSF Program" fields, select Contains from the drop-down list and enter the appropriate four-digit code for the program.
<http://www.nsf.gov/awardsearch/tab.do?dispatch=4>
- NSF 98-91: A Guide for Proposal Writing, a booklet prepared by staff in DUE
<http://www.nsf.gov/pubs/1998/nsf9891/nsf9891.pdf>
- NSF Grant Proposal Guide, detailed guidance for preparing and submitting a proposal to NSF
http://www.nsf.gov/pubs/policydocs/pappguide/nsf08_1/gpg081print.pdf
- Human Subjects: <http://www.nsf.gov/bfa/dias/policy/hsfaqs.jsp>

Resources for Project Evaluation

- NSF 02-057: The 2002 User-Friendly Handbook for Project Evaluation, a basic guide to quantitative and qualitative evaluation methods for educational projects <http://www.nsf.gov/pubs/2002/nsf02057/start.htm>
- NSF 97-153: User-Friendly Handbook for Mixed Method Evaluations, a monograph "initiated to provide

more information on qualitative [evaluation] techniques and ... how they can be combined effectively with quantitative measures" <http://www.nsf.gov/pubs/1997/nsf97153/start.htm>

- Online Evaluation Resource Library (OERL) for NSF's Directorate for Education and Human Resources, a collection of evaluation plans, instruments, reports, glossaries of evaluation terminology, and best practices, with guidance for adapting and implementing evaluation resources <http://oerl.sri.com/home.html>
- Field-Tested Learning Assessment Guide (FLAG): This website is designed for Science, Math, Engineering, and Technology Instructors who are interested in new approaches to evaluating student learning, attitudes, and performance. It has a primer on assessment and evaluation, classroom assessment techniques, discipline-specific tools, and resources - all in a searchable, downloadable data base, <http://www.flaguide.org/>
- Student Assessment of Learning Gains (SALG): An on-line survey that measures student perceptions of their learning gains due to any components within a course. Faculty can modify a template to match any and all features of their courses, have their students take the survey on-line, and have the data returned to them as either raw data or with simple statistical analysis, <http://www.salgsite.org/>

Pertinent Workshops, Studies and Reports on Undergraduate Education

- *Recommendations for Action in Support of Undergraduate Science, Technology, Engineering, and Mathematics and Recommendations for Urgent Action Project Kaleidoscope 2002, 2006* reports calling for "collective action" to share ideas and materials so that projects build on, connect to, and enhance the work of others. [http://www.pkal.org/documents/ ReportonReports.pdf](http://www.pkal.org/documents/ReportOnReports.pdf) and <http://www.pkal.org/documents/ReportOnReportsII.cfm>.
- *How Students Learn*, a 2005 NRC report on effective teaching mechanisms (emphasizes the importance of teaching subject matter in depth, eliciting and working with students' preexisting knowledge, and helping students develop the skills of self-monitoring and reflection). <http://www.nap.edu/books/0309074339/html/>
- *Invention and Impact: Building Excellence in Undergraduate Science, Technology, Engineering and Mathematics Education*, a 2004 report from an AAAS organized meeting of CCLI active faculty describing some of the successful efforts supported by the CCLI program and its predecessors (the Course and Curriculum Development (CCD), Instruction and Laboratory Improvement (ILI), and Undergraduate Faculty Enhancement (UFE) programs). http://www.aaas.org/publications/books_reports/CCLI
- *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future* Committee on Prospering in the Global Economy of the 21st Century: An Agenda for American Science and Technology, Committee on Science, Engineering, and Public Policy, a 2007 National Academies Press publication. http://www.nap.edu/catalog.php?record_id=11463

E. PROGRAM EVALUATION

The Division of Undergraduate Education (DUE) conducts an on-going program evaluation to determine how effectively the CCLI program is achieving its goal to stimulate, disseminate, and institutionalize innovative developments in STEM education through the production of knowledge and the improvement of practice. In particular, the program seeks to understand how effectively its projects are using current learning models in developing their innovations, contributing to knowledge on STEM education, and building a community of scholars in undergraduate STEM education. In addition to project-specific evaluations, all funded projects will be expected to cooperate with this third party program evaluation and respond to all inquiries, including requests to participate in surveys, interviews and other approaches for collecting data needed to evaluate the CCLI Program.

III. AWARD INFORMATION

NSF anticipates having \$35.8 million in FY 2010 for new CCLI awards and ongoing CCLI awards, pending the availability of funds. The awards will be made as standard or continuing grants for Type 1-3 projects and as grants or cooperative agreements for CCLI Central Resource projects. The number and size of awards will depend on the quality of the proposals received and the availability of funds. Total project budgets encompass all project years. The proposal budget must be commensurate with the project and thoroughly justified in the proposal. The expected number of awards, and duration and range of total NSF/DUE support over the lifetime of a CCLI project, including indirect costs, are as follows:

- **Type 1 Projects** – 70 to 75 awards expected, each with a duration of 2 to 3 years and a total budget up to \$200,000 (\$250,000 when four-year colleges and universities collaborate with two-year colleges).
- **Type 2 Projects** – 20 to 25 awards expected, each with a duration of 2 to 4 years and budget that fits the scope of the project. It is expected that the total budget for the majority of awards will be \$300,000 to \$600,000.
- **Type 3 Projects** – 3 to 5 awards expected, each with duration of 3 to 5 years and a budget that fits the scope of the project. It is expected that the total budget for the majority of these awards will be \$1,000,000 to \$5,000,000.
- **CCLI Central Resource Projects** – 1 to 3 awards expected, each with a budget and duration that fits the scope of the project. For example, small focused workshop projects will have a duration of 1 to 2 years with a total budget up to \$100,000; large scale projects will have a duration of 3 to 5 years with a total budget of \$300,000 to \$3,000,000.

For collaborative projects, these limits apply to the total project budget.

IV. ELIGIBILITY INFORMATION

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

Organization Limit:

None Specified

PI Limit:

None Specified

Limit on Number of Proposals per Organization:

None Specified

Limit on Number of Proposals per PI:

None Specified

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Instructions: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the guidelines specified 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-PUBS (7827) or by e-mail from nsfpubs@nsf.gov.

Additional Full Proposal Instructions:

The following information supplements the GPG:

- Proposers should make sure that their proposals respond to the list of questions provided both in the general review criteria and in the additional program-specific review criteria in Section VI.A below. They should review the discussion of the components, types, and important features in Section II above. Additional information on writing proposals can be found in "A Guide for Proposal Writing" (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf04016).
- Principal Investigators are strongly encouraged to match their proposed budgets carefully to the scope and scale of a project. Excessive or poorly justified budgets indicate that the project is not well designed.
- Principal Investigators are strongly encouraged to take advantage of the National STEM Distributed Learning (NSDL) resources for project dissemination. This involves contributing metadata about project sites and individual resources. Guidelines for contribution may be found at <http://nsdl.org/contribute>. NSDL resources also offer an array of technology tools and community support services that may be of utility to CCLI projects, including resource cataloging and collection management tools, as well as group workspaces and collaboration, outreach, and professional development opportunities. Inquiries may be submitted via <http://nsdl.org/about/contactus>. PIs may want to include funds in their budgets to cover required cataloging/metadata and/or software engineering expertise. They should contact the NSDL portal directly (<http://nsdl.org/about/contactus/>) to obtain more specific guidance on cost estimates for collection building and contribution to NSDL resources.
- All proposals must comply with the section of the GPG on Proposals Involving Human Subjects (http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg). The proposer should mark the Human Subjects box on the cover sheet and then indicate whether the proposed project is exempt, approved, or pending. THE PROCESS IS PENDING IF THE IRB HAS NOT YET APPROVED A SUBMITTED APPLICATION OR IF THE PROPOSER HAS NOT YET SUBMITTED AN APPLICATION. THIS SECTION SHOULD NOT BE LEFT BLANK.
- While all material relevant to determining the quality of the proposed work must be included within the 15-page Project Description or as part of the budget justification, proposers may, as a part of the Supplementary Documentation, include letters showing collaborator commitments and organizational endorsement. In addition, for those projects whose deliverables include a final product, samples of these products (such as excerpts from book chapters, assessment tools, screen shots of software, sample teaching modules and other project deliverables) may be placed within the Supplementary Documentation section. These sample materials should be concise and relevant.

Proposers are reminded to identify the program solicitation number (NSF 09-529) 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.

B. Budgetary Information

Cost Sharing: Cost sharing is not required under this solicitation.

Other Budgetary Limitations:

- NSF funds may not be used to support expenditures that would normally be made in the absence of an award, such as costs for routine teaching activities.

NSF project funds may not be used for:

- equipment or instrumentation that is not mainly for use in the project;
- replacement equipment or instrumentation that does not significantly improve instructional capability;
- vehicles, laboratory furnishings, or general utility items such as office equipment (including word-processing equipment), benches, tables, desks, chairs, storage cases, and routine supplies;
- maintenance equipment and maintenance or service contracts;
- the modification, construction, or furnishing of laboratories or other buildings;
- the installation of equipment or instrumentation (as distinct from the on-site assembly of multicomponent instruments--which is an allowable charge).

C. Due Dates

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

May 21, 2009

For Type 1 proposals from submitting organizations located in states or territories beginning with A through M.

May 22, 2009

For Type 1 proposals from submitting organizations located in states or territories beginning with N through W.

January 13, 2010

For Type 2 and 3 proposals and for CCLI Central Resource Project proposals. However, CCLI Central Resource Project proposals for small focused workshops may be submitted at any time after consulting with a program officer.

D. FastLane Requirements

Proposers are required to prepare and submit all proposals for this program solicitation through use of the NSF FastLane system. Detailed instructions regarding the technical aspects of proposal preparation and submission via FastLane are available at: <http://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.

Submission of Electronically Signed Cover Sheets. The Authorized Organizational Representative (AOR) must electronically sign the proposal Cover Sheet to submit the required proposal certifications (see Chapter II, Section C of the [Grant Proposal Guide](#) for a listing of the certifications). The AOR must provide the required electronic certifications within five working days following the electronic submission of the proposal. Further instructions regarding this process are available on the FastLane Website at: <https://www.fastlane.nsf.gov/fastlane.jsp>.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program where they will be reviewed if they meet NSF proposal preparation requirements. 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 who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with the 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.

A. NSF Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board (NSB)-approved merit review criteria: intellectual merit and the broader impacts of the proposed effort. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two NSB-approved merit review criteria are listed below. The criteria include considerations that help define them. These considerations are suggestions and not all will apply to any given proposal. While proposers must address both merit review criteria, reviewers will be asked to address only those considerations that are relevant to the proposal being considered and for which the reviewer is qualified to make judgements.

What is the intellectual merit of the proposed activity?

How important is the proposed activity to advancing knowledge and understanding within its own field or across different fields? How well qualified is the proposer (individual or team) to conduct the project? (If appropriate, the reviewer will comment on the quality of the prior work.) To what extent does the proposed activity suggest and explore creative, original, or potentially transformative concepts? How well conceived and organized is the proposed activity? Is there sufficient access to resources?

What are the broader impacts of the proposed activity?

How well does the activity advance discovery and understanding while promoting teaching, training, and learning? How well does the proposed activity broaden the participation of underrepresented groups (e.g., gender, ethnicity, disability, geographic, etc.)? To what extent will it enhance the infrastructure for research and education, such as facilities, instrumentation, networks, and partnerships? Will the results be disseminated broadly to enhance scientific and technological understanding? What may be the benefits of the proposed activity to society?

Examples illustrating activities likely to demonstrate broader impacts are available electronically on the NSF website at: <http://www.nsf.gov/pubs/gpg/broaderimpacts.pdf>.

Mentoring activities provided to postdoctoral researchers supported on the project, as described in a one-page supplementary

document, will be evaluated under the Broader Impacts criterion.

NSF staff also will give careful consideration to the following in making funding decisions:

Integration of Research and Education

One of the principal strategies in support of NSF's goals 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 diversity of learning perspectives.

Integrating Diversity into NSF Programs, Projects, and Activities

Broadening opportunities and enabling the participation of all citizens -- women and men, underrepresented minorities, and persons with disabilities -- 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.

Additional Review Criteria:

In reviewing CCLI proposals, the standard criteria will be expanded to include the following additional review criteria as appropriate to the type and main component of the proposed work:

Intellectual Merit: Will the project produce exemplary material, processes, or models that enhance student learning? Will evaluation and research projects yield important findings related to student learning? Does the project build on existing knowledge about STEM education? Are appropriate expected measurable outcomes explicitly stated and are they integrated into an evaluation plan? Is the evaluation effort likely to produce useful information?

Broader Impacts: Will the project contribute to the understanding of STEM education? Will the project help build the STEM education community? Will the project have a broad impact on STEM education in an area of recognized need or opportunity? Does the project have the potential to contribute to transformative change in undergraduate STEM education?

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Panel Review.

Reviewers will be asked to formulate a recommendation to either support or decline each proposal. 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 is striving to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director accepts the Program Officer's recommendation.

A summary rating and accompanying narrative will be completed and submitted by each reviewer. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers, 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.

In all cases, 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 and 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.

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 letter, 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 letter; (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 letter. 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.

*These documents may be accessed electronically on NSF's Website at

http://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

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 before the end of the current budget period. (Some programs or awards require more frequent project reports). Within 90 days after expiration of a grant, the PI also is required to submit a final project report.

Failure to provide the required annual or final project reports will delay NSF review and processing of any future funding increments as well as any pending proposals for that PI. 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 FastLane, for preparation and submission of annual and final project reports. Such reports provide information on activities and findings, project participants (individual and organizational) publications; and, other specific products and contributions. PIs will not be required to re-enter information previously provided, either with a proposal or in earlier updates using the electronic system. Submission of the report via FastLane constitutes certification by the PI that the contents of the report are accurate and complete.

In addition, PIs of CCLI grants will also be expected to cooperate with data collection associated with the CCLI program evaluation conducted by a third party organization supported by NSF.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Russell Pimmel, Lead Program Director, telephone: (703) 292-4618, email: rpimmel@nsf.gov
- Myles Boylan, Lead Program Director, telephone: (703) 292-4617, email: mboylan@nsf.gov
- Terry Woodin, Lead Program Director, telephone: (703) 292-4657, email: twoodin@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.
- Antionette T. Allen, telephone: (703) 292-4646, email: duefl@nsf.gov

Proposers are encouraged to contact a DUE Program Director in their discipline:

Biological Sciences

- Deborah Allen, Program Director, telephone: (703)292-4653, email: deallen@nsf.gov
- Kathleen Bergin, Program Director, telephone: (703)292-5171, email: kbergin@nsf.gov
- Linnea Fletcher, Program Director, telephone: (703)292-4634, email: lafletch@nsf.gov
- James Hamos, Program Director, telephone: (703)292-4687, email: jhamos@nsf.gov
- Joan Prival, Program Director, telephone: (703)292-4635, email: jprival@nsf.gov
- Daphne Rainey, Program Director, telephone: (703)292-4671, email: drainey@nsf.gov
- Terry Woodin, Program Director, telephone: (703)292-4657, email: twoodin@nsf.gov

Chemistry

- Eun-Woo Chang, Program Director, telephone: (703)292-4674, email: ewchang@nsf.gov
- Susan Hixson, Program Director, telephone: (703)292-4623, email: shixson@nsf.gov
- Bert Holmes, Program Director, telephone: (703)292-5128, email: bholmes@nsf.gov
- Eileen Lewis, Program Director, telephone: (703)292-4627, email: ellewis@nsf.gov
- Herbert Richtol, Program Director, telephone: (703)292-4648, email: hrichtol@nsf.gov
- Curtis Sears, Program Director, telephone: (703)292-4639, email: csears@nsf.gov
- Hannah Sevian, Program Director, telephone: (703)292-5108, email: hsevian@nsf.gov

Computer Science

- Guy-Alain Amoussou, Program Director, telephone: (703)292- 4645, email: gamousso@nsf.gov
- Scott Grissom, Program Director, telephone: (703)292-4643, email: sgrissom@nsf.gov
- Victor Piotrowski, Program Director, telephone: (703)292-5141, email: vpotrow@nsf.gov

Engineering

- Ann McKenna, Program Director, telephone: (703)292-4629, email: amckenna@nsf.gov
- Lance Perez, Program Director, telephone: (703)292-4640, email: lperez@nsf.gov
- Russell Pimmel, Program Director, telephone: (703)292-4618, email: rpimmel@nsf.gov

Geological Sciences

- David Matty, Program Director, telephone: (703)292-5323, email: dmatty@nsf.gov

Interdisciplinary

- Daphne Rainey, Program Director, telephone: (703)292-4671, email: drainey@nsf.gov
- Herbert Richtol, Program Director, telephone: (703)292-4648, email: hrichtol@nsf.gov
- Curtis Sears, Program Director, telephone: (703)292-4639, email: csears@nsf.gov

Mathematics

- Dennis Davenport, Program Director, telephone: (703)292-4659, email: ddavenpo@nsf.gov
- Stephanie Fitchett, Program Director, telephone: (703)292-4653, email: sfitchet@nsf.gov
- Daniel Maki, Program Director, telephone: (703)292-4620, email: dmaki@nsf.gov

Physics / Astronomy

- Joyce Evans, Program Director, telephone: (703)292-5098, email: jevans@nsf.gov
- John Mateja, Program Director, telephone: (703)292-4641, email: jmateja@nsf.gov
- Duncan McBride, Program Director, telephone: (703)292-4630, email: dmcbride@nsf.gov

Research / Assessment

- Myles Boylan, Program Director, telephone: (703)292-4617, email: mboylan@nsf.gov
- Connie Della-Piana, Program Director, telephone: (703)292-5309, email: cdellapi@nsf.gov

Social Sciences

- Myles Boylan, Program Director, telephone: (703)292-4617, email: mboylan@nsf.gov
- Connie Della-Piana, Program Director, telephone: (703)292-5309, email: cdellapi@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, National Science Foundation Update is a free e-mail subscription service 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 Regional Grants Conferences. Subscribers are informed through e-mail when new publications are issued that match their identified interests. Users can subscribe to this service by clicking the "Get NSF Updates by Email" link on the [NSF web site](#).

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>.

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 40,000 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 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

- **To Order Publications or Forms:**

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
Division of Administrative Services
National Science Foundation
Arlington, VA 22230

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