Innovative Technology Experiences for Students and Teachers (ITEST)

PROGRAM SOLICITATION
NSF 09-506

REPLACES DOCUMENT(S):
NSF 08-526

National Science Foundation

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

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

January 12, 2009

ITEST

January 19, 2010

ITES

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

February 20, 2009

ITEST

February 24, 2009

Innovation through Institutional Integration (I^3)

August 25, 2009

Innovation through Institutional Integration (I^3)

February 12, 2010

ITEST

REVISION NOTES

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).

The ITEST *Studies* projects have been renamed ITEST *Research* projects in this revision. A new track for *Conferences and Workshop*s has been added.

A track for *Innovation through Institutional Integration (I^3)* is included. I^3 challenges faculty, administrators, and others in institutions to think strategically about the creative integration of NSF-funded awards and is itself an integrative, cross-cutting effort within the Directorate for Education and Human Resources (EHR). For Fiscal Year 2009, proposals are being solicited in nine EHR programs that advance I^3 goals:

- Centers of Research Excellence in Science and Technology (CREST)
- Research on Gender in Science and Engineering (GSE)
- Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)
- Innovative Technology Experiences for Students and Teachers (ITEST)
- Alliances for Broadening Participation in STEM: Louis Stokes Alliances for Minority Participation (LSAMP)
- Math and Science Partnership (MSP)
- Robert Noyce Teacher Scholarship Program
- Research in Disabilities Education (RDE)
- Tribal Colleges and Universities Program (TCUP)

All proposals submitted to I^3 through these programs have a common due date and will be reviewed in competition with one another. Eligibility is limited to institutions of higher education (including two- and four-year colleges). If the proposal is exclusively

for I^3 STEM educational or related research, then all categories of proposers identified in the NSF Grant Proposal Guide are eligible to submit. Given the focus on institutional integration, an institution may submit only one proposal to the I^3 competition for each deadline.

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:

Innovative Technology Experiences for Students and Teachers (ITEST)

Synopsis of Program:

The ITEST program responds to current concerns and projections about the growing demand for professionals and information technology workers in the U.S. and seeks solutions to help ensure the breadth and depth of the STEM workforce. ITEST supports research studies to address questions about how to find solutions. It also supports the development, implementation, testing, and scale-up of implementation models. A large variety of possible approaches to improving the STEM workforce and to building students' capacity to participate in it may be implemented and studied. ITEST projects may include students or teachers, kindergarten through high school age, and any area of the STEM workforce. Projects that explore cyberlearning, specifically learning with cyberinfrastructure tools such as networked computing and communications technologies in K-12 settings, are of special interest.

This program is interested in addressing such questions as: What does it take to effectively interest and prepare students to participate in the science, technology, engineering, and mathematics (STEM) workforce of the future? What are the knowledge, skills, and dispositions that students need in order to participate productively in the changing STEM workforce and be innovators, particularly in STEM-related networked computing and information and communication technology (ICT) areas? How do they acquire them? How can the Nation's burgeoning cyberinfrastructure be harnessed as a tool for STEM learning in classrooms and informal learning environments? What will ensure that the nation has the capacity it needs to participate in transformative, innovative STEM advances? How can we assess and predict inclination to participate in the STEM fields and how can we measure and study impact of various models to encourage that participation?

Four types of projects are invited:

Research projects enrich the understanding of issues related to enlarging the STEM workforce. Research projects may conduct efficacy and effectiveness studies of intervention models, conduct longitudinal studies of efforts to engage students in the STEM areas, develop instruments to assess engagement, persistence, and other relevant constructs of student motivation, or conduct studies to identify predictors of student inclination to pursue STEM career trajectories. The program is especially interested in projects that target students from groups that are underserved and underrepresented in STEM and ICT-intensive careers, including those residing in rural and economically disadvantaged communities.

Strategies projects design, implement, and evaluate models for classroom, after-school, summer, virtual, and/or year-round learning experiences for students and/or teachers. The strategies are intended to encourage students' readiness for, and their interest and participation in, the STEM workforce of the future. Strategies project proposals must describe the anticipated contribution to the research knowledge base about STEM career preparation in addition to immediate impacts on participants.

Scale-up projects implement and test models to prepare students for information technology or the STEM workforce of the future in a large-scale setting such as at state or national level. A scale-up project must be based on evidence of demonstrated success from an existing strategy for students or teachers.

Conferences and Workshops target STEM educators (from both the formal and informal education communities), educational researchers, and evaluators. The proposed conferences would be expected to contribute to the development of a research agenda on K-12 STEM workforce preparation and development issues, workforce participation, and cyberlearning. Conferences or workshops must be designed to bring together individuals with expertise in technology and STEM education, career development, cognitive science, sociology, anthropology, science fields, and other communities that are invested in STEM workforce careers. Evaluation approaches for innovative STEM and ICT workforce motivation, preparation, and development models are also sought.

Innovation through Institutional Integration (I^3) projects enable faculty, administrators, and others in institutions to think and act strategically about the creative integration of NSF-funded awards, with particular emphasis on awards managed through programs in the Directorate for Education and Human Resources (EHR), but not limited to those awards. For Fiscal Year 2009, proposals are being solicited in nine EHR programs that advance I^3 goals: CREST, GSE, HBCU-UP, ITEST, LSAMP, MSP, Noyce, RDE, and TCUP.

Cognizant Program Officer(s):

- Address questions to, telephone: (703) 292-8628, email: DRLITEST@nsf.gov

- Julia V. Clark, ITEST co-lead, telephone: (703) 292-5119, email: jclark@nsf.gov
- Sylvia M. James, ITEST co-lead, telephone: (703) 292-5333, email: sjames@nsf.gov
- Larry E. Suter, ITEST co-lead, telephone: (703) 292-5144, email: lsuter@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: 25 to 40 in each year for ITEST awards depending on the availability of funds for FY 2009 and FY 2010. Up to 12 continuing awards will be made in the Innovation through Institutional Integration (I3) activity for the February 24, 2009, competition, pending availability of funds. Up to 12 continuing I3 awards will also be made in Fiscal Year 2010 for the August 25, 2009, competition, pending availability of funds.

Anticipated Funding Amount: $35,000,000 in each year for new Innovative Technology Experiences for Students and Teachers (ITEST) projects in FY 2009 and FY 2010 pending availability of funds. $10,000,000 for Innovation through Institutional Integration (I3) projects across multiple EHR programs for each of Fiscal Years 2009 and 2010, pending the availability of funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

- ITEST: Only U.S. organizations located in the U.S. with an educational mission are eligible to apply; see the NSF Grant Proposal Guide (GPG) for further information.

  Eligibility for Innovation through Institutional Integration (I^3) is limited to institutions of higher education (including two- and four-year colleges) accredited in, and having a campus located in the US. If the proposal is exclusively for I^3 STEM educational or related research, then all categories of proposers identified in the NSF Grant Proposal Guide are eligible to submit.

PI Limit:

The Principal Investigator for an Innovation through Institutional Integration (I^3) proposal must be the university provost or equivalent chief academic officer, unless the proposal is exclusively for I^3 STEM educational or related research.

Limit on Number of Proposals per Organization:

There is no limit on the number of proposals per organization for ITEST.

For Fiscal Year 2009, proposals are being solicited in nine EHR programs that advance the goals of Innovation through Institutional Integration (I^3): CREST, GSE, HBCU-UP, ITEST, LSAMP, MSP, Noyce, RDE, and TCUP. Given the focus on institutional integration, an institution may submit only one proposal to the I^3 competition for each deadline.

Limit on Number of Proposals per PI:

An individual may serve as the Principal Investigator (PI) for no more than one Research, Strategies, or Scale-up proposal under this solicitation.

Innovation through Institutional Integration (I^3): no limit specified.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Submission of Letters of Intent is required. Please see the full text of this solicitation for further information.
- **Preliminary Proposal Submission:** Not Applicable
- **Full Proposal Preparation Instructions:** This solicitation contains information that deviates from 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

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

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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.

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I. INTRODUCTION

About the National Science Foundation and the Directorate for Education and Human Resources

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 and research-based leadership in STEM education. EHR promotes six themes in fulfilling this responsibility through:

1. Broadening participation to improve workforce development;
2. Promoting cyber-enabled learning strategies to enhance STEM education;
3. Enriching the education of STEM teachers;
4. Furthering public understanding of science and advancing STEM literacy;
5. Career development--graduate education and beyond, preparing scientists and engineers for tomorrow; and
6. Promoting learning through research and evaluation.

To address these themes, the Directorate sponsors programs in the Divisions of Research on Learning in Formal and Informal Settings (DRL), Undergraduate Education (DUE), Graduate Education (DGE), and Human Resource Development (HRD).

About the Division of Research on Learning in Formal and Informal Settings

DRL invests in projects to enhance STEM learning for people of all ages. Its mission includes promoting innovative and transformative research, development, and evaluation of learning and teaching in all STEM disciplines in both formal and informal learning settings. DRL programs encourage the participation of scientists, engineers, and educators from the range of disciplines represented at NSF. New and emerging areas of STEM must figure prominently into efforts to improve STEM education. The integration of cutting-edge STEM content and the engagement of STEM researchers is encouraged in all DRL initiatives. In the larger context of Federal support for education research and evaluation, DRL's role is to be a catalyst for change, advancing theory, method, measurement, development, evaluation, and application in STEM education. The Division seeks to support both early, promising innovations, as well as larger-scale adoptions of proven educational innovations. In doing so, it challenges the field to create the ideas, resources, and human capacity to bring about the needed transformation of STEM education for the 21st century.

The Division's programs offer a set of complementary approaches for advancing research, development, and field-based improvements.

- The Innovative Technology Experiences for Students and Teachers (ITEST) program enhances participation in the U.S. STEM workforce through the design, implementation, scale-up and testing of strategies for students and/or teachers, and through research studies about issues related to STEM workforce participation.
- The Discovery Research K-12 (DR-K12) program enables significant advances in preK-12 student and teacher learning of the STEM disciplines through research and development of innovative resources, models, and technologies for use by students, teachers, administrators and policy makers.
- The Research and Evaluation on Education in Science and Engineering (REESE) program advances research at the frontiers of STEM learning, education, and evaluation, and provides the foundational knowledge to improve STEM teaching and learning at all educational levels and in all settings.
- The Informal Science Education (ISE) program builds on educational research and practice to increase interest in, engagement with, and understanding of STEM by individuals of all ages and backgrounds through self-directed learning experiences.

Each of these programs is intended to improve the capacity of their respective fields to further STEM learning. They are central to NSF's strategic goals of *Learning* and *Discovery,* helping to cultivate a world-class, broadly inclusive STEM workforce, expanding the scientific literacy of all citizens, and promoting research that advances the frontiers of knowledge.

All research and development activities within DRL aim at generating knowledge and transforming practice in STEM education. DRL's programs are designed to complement each other within a cycle of innovation and learning (see Figure 1) that forms the conceptual framework for its programs (adapted from RAND, 2003, American Statistical Association, 2007; NSF, 2005). All DRL programs are concerned with all five components of the cycle, to different degrees.

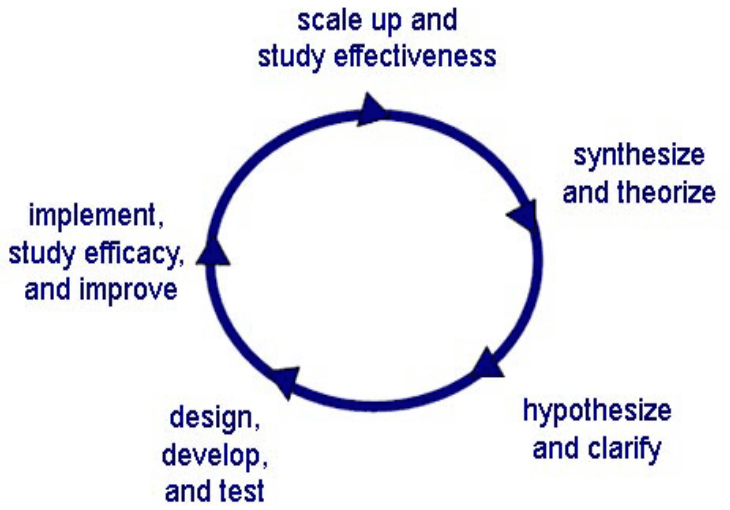

Figure 1. Cycle of Innovation

Each part of the cycle, represented by the activities of DRL's programs, forms the vital and compelling foundation for transition to the next part of the cycle; the research, development, and implementation activities need to be rigorous, as appropriate. From challenging the STEM educational and research communities with transformative ideas, to conducting the pioneering and pragmatic research necessary to advance those goals, to developing world-class instructional materials and resources for teachers and students to advance their knowledge of STEM teaching and learning, to engaging all citizens and residents of the United States in learning and as future technologists, scientists and engineers, DRL is providing the ideas, resources, and human capacity to

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advance STEM learning and education in the 21 century.

In contrast with other DRL programs (ISE, DR-K12, REESE), ITEST specifically focuses on issues of *STEM learning and motivation as they lead to STEM workforce development, participation, and improvement*. ITEST emphasizes the **design**, **implement, and synthesize** components of the DRL Cycle of Innovation, as well as the role of motivation in preparation and participation. The outcomes of ITEST projects include research tools and findings that build the knowledge base about approaches, models, and interventions with K-12 students and teachers that increase the U.S. capacity for innovation in the STEM workforce of the future. Other ITEST outcomes may be strategies that encourage K-12 students to consider and prepare for careers in STEM and information technology, including those that utilize cyberinfrastructure tools such as networked computing information and communications technologies. In contrast, the outcomes of ISE projects are research, development, and evaluation of self-directed learning experiences in out-of-school contexts that increase interest, engagement, and understanding of STEM by individuals of all ages and backgrounds, building on educational research and practice. DR-K12 projects generate resources, models, or technologies that are grounded in or informed by research or practice, as well as research findings about the implementation and impact of K-12 STEM education resources, models and technologies. The primary outcomes of REESE projects are research findings, methods, and theoretical perspectives.

The ITEST program complements the goals of the Advanced Technological Education (ATE) program. While the ATE program focuses primarily on technician education at the community college level, ITEST projects focus on students at the K-12 level in an effort to ensure that they possess the motivation and capacity to enter educational and training programs that lead to STEM careers.

In addition, proposals submitted to the Innovation through Institutional Integration (I^3) track would request support for projects that enable faculty, administrators, and others in institutions to think and act strategically about the creative integration of NSF-funded awards, with particular emphasis on awards managed through programs in the Directorate for Education and Human Resources (EHR), but not limited to those awards. For Fiscal Year 2009, proposals are being solicited in nine EHR programs that advance I^3 goals: CREST, GSE, HBCU-UP, ITEST, LSAMP, MSP, Noyce, RDE, and TCUP.

II. PROGRAM DESCRIPTION

The ITEST program is funded by H-1B visa revenues in direct response to the need to ensure a high-quality future STEM workforce that can meet U.S. technology needs. The goals of the ITEST program are to

- To produce research findings that build knowledge about approaches, models, and interventions with K-12-aged children and teachers that are most likely to increase the nation's capacity and innovation in the STEM workforce of the future.
- To develop, implement, study and evaluate strategies that encourage K-12 students to develop interest in and to be prepared for careers in the STEM workforce of the future.
- To equip teachers with the resources to ensure that their students consider choosing and are prepared to enter the STEM workforce of the future.

For the purposes of this program, the "STEM workforce of the future" is defined broadly to include technologists, scientists, engineers, and mathematicians. The STEM workforce of the future is likely to require knowledge and experience with information and communication technologies (ICT) especially in fields such as nanotechnology, biotechnology, and computational biology (NRC, 2006). Therefore, ITEST proposals may focus on any STEM or ICT-intensive area provided the project addresses specific needs of K-12-aged students or teachers preparing for the future U.S. workforce. Investigators may identify established or emerging STEM areas of focus and create research projects or new strategies within those areas that may yield further development of innovation or capacity of the STEM workforce of the future. In addition to technical and STEM content, as a secondary focus, projects may provide the opportunity for students to learn and practice essential skills (e.g., conflict management, leadership, knowledge of workplace ethics, negotiation, or self-direction) (US Department of Labor, 1991).

The ITEST program is aligned with the recommendations of the recent report, *Fostering Learning in the Networked World: The Cyberlearning Opportunity and Challenge*. Cyberlearning is the term applied to "learning that is mediated by networked computing and communications technologies" (Borgman et al., 2008). The report outlines an agenda for research and development of new learning opportunities created by the growth of the digital environment and how it will affect educational institutions in the 21st century. ITEST's dual emphasis on innovation and technology make this program ideal for the creation of transformative models utilizing cyberinfrastructure in future learning environments that will provide students with the competencies necessary to be successful in the STEM workforce of the future.

The ability of the Nation to meet the demand for individuals with the knowledge, skills, curiosity, and creativity necessary to enter the STEM workforce and ICT-intensive careers is aggravated by the limited involvement of segments of the population that are severely underrepresented and underserved in STEM occupations. The demand for skilled, knowledgeable professionals can be met only if the STEM workforce is broad and diverse, and taps the potential of all students able to pursue careers in STEM fields. NSF is especially interested in projects that focus on students from groups underserved and underrepresented in STEM and technology careers, including but not limited to those residing in rural and economically disadvantaged communities.

ITEST invests in four types of projects. ***Research*** projects, ***Strategies*** projects, ***Scale-up*** projects, and ***Conferences and Workshops*** are described below.

A. ITEST Research projects

The goal of ITEST *Research* projects is to produce empirical findings and research tools that contribute to knowledge about which approaches, models, and interventions with K-12 students and teachers are most likely to increase capacity in the STEM workforce of the future.

Effective strategies must be developed and studied for engaging American youth of the 21st century in information technology and STEM learning in a manner that leads them to pursue career trajectories that focus on technology-intensive STEM fields. Research in this area has the potential to transform policy and education in STEM. To that end, the ITEST program is seeking projects that bring together researchers in STEM education, career development, psychology, sociology, anthropology, science fields, and other communities that are invested in workforce development. Projects in this category are guided by the following questions

- What educational activities would increase the nation's capacity to participate in transformative, innovative discoveries in STEM?
- How can we assess and predict inclination to participate in the STEM careers?
- How can we measure and study the impact of various models to encourage participation in STEM careers?
- Do experiences of K-12 students received outside of the formal school setting contribute significantly to choosing STEM

careers?

These general questions signal areas where ITEST will support systematic, rigorous studies to rapidly enlarge and solidify the knowledge base upon which efforts to improve and expand the STEM and ICT-intensive workforce can build. Research studies to examine the effectiveness of currently active or previously developed interventions and strategies for ICT workforce growth are encouraged.

ITEST supports research projects designed to improve the understanding of factors that increase the STEM workforce. The ITEST program invites proposers to formulate research questions that will be examined empirically using appropriately rigorous methods to help enrich understanding of the best ways to continue systematic building of the STEM, especially ICT-intensive, workforce. ITEST *Research* projects are expected to identify critical questions that relate to student STEM learning and engagement in STEM careers, teacher knowledge about STEM career issues and workplace demands, and the characteristics of effective STEM education that foster sustained interest and entry into STEM career paths.

Relevant research questions include but are not limited to:

What factors sustain students' interest and participation in STEM careers? How are middle and high school students using ICT in school and outside of school? Do STEM and/or ICT-related learning opportunities in school settings and informal settings impact students' decisions about pursuing STEM and/or ICT-intensive careers? In what ways? What are the characteristics of instruction or experiences that are effective in motivating students to consider STEM and ICT-intensive fields or to be successful in such fields? The proposed topics, questions, methodologies, and research settings must be consistent with the goals of the ITEST program. Research problems, questions, and methods must be clearly aligned. A broad range of study designs is encouraged including exploratory, evaluative, experimental, quasi-experimental, cross-sectional survey, longitudinal survey, and ethnographic descriptive designs.

Because of the pressing need to understand how to build a larger and more effective STEM workforce, and particularly the information technology workforce, the ITEST program is interested in studies that will produce causal claims about the relative impact of different strategies or approaches to interest students in STEM careers. ITEST supports projects in a variety of learning settings. The ITEST program is especially interested in understanding the process of transferring skills and knowledge gained in out-of-school and classroom settings to the workforce. Also, the program is concerned with understanding how career trajectories within particular STEM fields are developed, particularly in emphasis areas such as ICT. In addition, the ITEST Program invites studies to advance methodology for longitudinal work, to produce instruments, or to develop theoretical constructs.

Research project proposals must

1. State the research questions and issues that will be addressed in the study, and provide a rationale based in previous literature or theory for why investigation of the questions and issues will help to build knowledge about how K-12 students and teachers can become engaged in building STEM workforce capacity. The proposal should demonstrate clearly how the research builds on existing evidence from prior research in STEM education. All proposals must incorporate a discussion of literature on relevant domains related to the STEM workforce of the future.
2. Identify gaps in the knowledge base on the STEM workforce and propose areas of research to address key issues. For instance, many projects have made the assumption that early engagement and participation in STEM activities might lead to later career choice in these areas; how well supported is this assumption by available research? What kinds of studies and tools need to be developed to deepen understanding of how different strategies affect workforce capacity?
3. Describe the research design to be employed, and make a case that the methodology to be employed is suitably appropriate to the particular questions being pursued. Describe any instruments or measures that will be used or developed, and provide evidence of the reliability and validity of adopted measurement methods. ITEST does not prescribe any particular methodology or design, but rather seeks innovative designs that will permit exploration of the research questions.
4. Describe the data to be gathered and plans for analysis. If, for instance, the main point of the project is to develop a survey instrument that might be used to determine the nature of STEM workforce problem-solving demands in fast-growing technology areas, this section should describe plans for validation of the instrument.
5. Indicate plans for publication and dissemination. Include plans for interaction with implementation communities that are positioned to provide programs for teachers and students that will increase STEM participation as well as for interaction with policy makers who can use research results as a basis for improving the STEM workforce of the future.
6. Describe the nature of expertise needed to conduct the research and how the research team has that expertise.

Research projects may be up to three years in duration and be awarded up to $1.5 million. The size and duration of the request should be appropriate to the scope of the project.

The program will also accept a few proposals of a longer period and greater level of support that either develop or draw upon national databases to study the effect of elementary and secondary school period experiences on student choices of STEM careers.

B. ITEST Strategies projects

The goal of ITEST *Strategies* projects is to develop, implement and study strategies that encourage K-12 students to consider and be prepared for careers in the STEM and information technology fields, or that equip teachers with the resources to ensure that their students consider and are prepared for choosing to enter the STEM workforce of the future. Investigators might develop innovative strategies to engage parents and other caregivers in the development of K-12 students' understanding and appreciation of careers in the STEM fields or their motivation to consider such career areas. *Every strategies project is regarded as a learning laboratory in the sense that other STEM educators should be able to gain knowledge provided by the project in other, future activities. Strategies projects should describe the anticipated contribution the project will make to the knowledge base about STEM education, in addition to short-term impacts on participants.*

Projects in this category are guided by the following questions

- What strategies will best support student development for productive participation in the STEM and ICT workforce of the future?
- What are the knowledge, skills, and dispositions that students need in order to participate productively in the changing workforce in STEM, and how can we prepare teachers to help students acquire such knowledge, skills, and dispositions?
- How can the burgeoning cyberinfrastructure be harnessed as a tool for STEM learning in classrooms and informal learning environments?
- What strategies can parents and caregivers adopt in the modern digital and computer age that develop student understanding of and appreciation for the scientific, mathematical, and engineering basis of technological developments?

Strategies projects include the design, implementation, and testing of research and theory-based models, or models based in best practice and professional expertise, to interest and to prepare students to be participants in the STEM workforce of the future. Investigators should articulate a strategy for engaging students in the STEM workforce of the future, and for identifying and building knowledge, skills, and dispositions that are essential for participation in that workforce. The project should include a clear association of the STEM content to be addressed with the STEM or ICT career that it supports. Although a range of types of strategies and

models are expected, any strategy proposal must directly impact K-12 students or K-12 teachers.

Investigators are encouraged to create partnerships with K-12 schools, industry, colleges, universities, informal science education organizations, government laboratories, and community-based organizations to address the needs of the target audiences as appropriate. Partnerships can provide opportunities for career exploration and mentoring, interactions with technology and STEM professionals, and workplace applications of technology skills.

The ITEST program strongly encourages innovative strategies with the potential to transform STEM learning in support of workforce development. Student involvement could take many forms. A project might include an activity in a local ICT industry to engage and interest students or a research-and-development effort to enhance particular types of STEM learning that are workforce-focused. Or it might include a program that brings together students and teachers in pursuit of STEM workforce-related topics. Or, a project might engage a community-based after-school program with engineers and scientists. Similarly, teacher projects might include school-based professional development programs, engagement in after-school or informal science education programs with students, university courses, internships in industry, etc. Ideally, a project should be practical and have the potential to be sustained or replicated elsewhere without continued support of federal funds.

Strategies project proposals must

1. Make a case for the potential of the strategy on the basis of research about workforce development, teaching and learning, and STEM workplace demands; or make a case on the basis of evidence from experience, professional judgment, and/or other relevant theory or arguments that support the strategy. Describe in detail the results of studies that provide indication of the promise of the strategy in new conditions if the strategy has been implemented previously and if the proposal is for a significant modification that will tailor the design to meet the needs of a new audience or community. For instance, if the strategy is to help teachers of science ensure that their students have opportunities to engage in creative design activities, then the proposal should draw on relevant literature to explain why this strategy is likely to lead to increased involvement in STEM careers or the ICT-intensive workforce.
2. Clearly explain and describe the strategy for creating a linkage between the STEM content and workforce preparedness. For example, if the strategy for building the STEM or ICT-intensive workforce is to engage students in exciting STEM after-school experiences with teachers, then the proposal should describe in detail the nature of the after-school experience, the materials to be produced, and how the design will be rigorous and systematic. If the strategy is to provide a mentoring program for students, describe how this will be accomplished.
3. Describe the plans for implementation of the strategy. This might include pilot testing, materials development, plans for dissemination and adoption by partnering organizations, changes in policy, or innovations in teacher education courses. Include plans for sustainability as appropriate that clearly show what parts of the project are sustainable and how they will be supported.
4. Include educational researchers as part of the project team or advisory committee to ensure that appropriate connections are made to the literature on related studies, models, and impacts.
5. Explain the intended immediate participant impacts and longer-term outcomes (e.g., contributions to the knowledge base) that are anticipated and describe how these outcomes are related to the strategy. Provide sufficient detail about how the progress toward the goals will be measured, including what instruments and research or evaluation design will be used. How will the process demonstrate the impact of the model and the viability and potential of the strategy? What data about the strategy, its implementation, and its impact will be gathered? How will the results ensure that the knowledge base about how to improve the workforce in STEM is enriched?

Strategies projects must have an implementation or direct services component for students, parents, teachers, STEM professionals, and/or the public. The implementation and direct services part of the project enables building the knowledge base about what it takes to enhance the STEM workforce of the future. A major contribution of strategies projects should be to provide evidence for this knowledge base through a systematic research or evaluation component.

Strategies projects can be up to three years in duration with award sizes at most $1.2 million. The size and duration of the request should be appropriate to the scope of the project.

C. ITEST Scale-up projects

The goal of ITEST *Scale-up* projects is to apply strategies to enhance student or teacher knowledge of, or disposition toward STEM careers for the purpose of learning effective steps in expanding the adoption of successful innovations in school and non-school settings. *Scale-up* projects include expanding existing designs, implementations, and tests of research and theory-based models or models based in best practice and professional expertise to interest and prepare students to be participants in the STEM workforce of the future. Investigators should articulate a strategy for engaging students in the STEM workforce of the future, or for identifying and building knowledge, skills, and dispositions that are essential for participation in that workforce.

Scale-up has been defined as "the enactment of interventions whose efficacy has already been established in new contexts with the goal of producing similar positive impacts in larger, frequently more diverse populations" (Schneider & McDonald, 2007). Dede and colleagues have provided additional guidance about the definition of a scale-up innovation in education that clarifies steps that lead toward adoption of strategies in education. Before attempting to conduct a strategy in a new setting, the education innovation must have been shown to produce “deep and consequential changes in practice” in one setting (Dede, Honan, & Peters, 2005; Dede & Rockman, 2007).

Any *scale-up* proposal must directly impact K-12-aged students or teachers of K-12 students and must involve a partnership among different types of institutions.

Projects in this category are guided by the following questions

- Can innovative strategies that have been shown to be effective for supporting K-12 students' development for productive participation in the STEM workforce of the future be applied to new settings?
- What evidence can be generated to clearly demonstrate that innovations applied in some settings can be expanded to new settings to increase the knowledge, skills, and dispositions that students need in order to participate productively in the changing workforce in STEM, especially ICT intensive workforce?
- How can innovations be expanded to cover additional scope within STEM workforce preparation?

The proposal should describe in detail the results of efficacy studies that provide evidence for the promise of the strategy and the conditions under which it was previously implemented.

Scale-up project proposals must

1. Identify the program, model, strategy, or intervention that will be scaled-up and explain the nature of the scale-up (e.g., size of affected population, variety of contexts). The proposal should make an argument for why the strategy is ready for scale-up, and provide empirical or theoretical evidence for the viability of the scale-up. Provide any scientifically based theory (cognitive, developmental, or other learning science theory) that strongly suggests that the proposed innovation will be

successful in a larger scale.
2. Describe the plan for implementing the scaled-up version, including the population, the participants and any planned adaptations of the earlier model. The interventions may be school-based or based outside of school and should use modern forms of technology or networking (see *Cyberlearning* report) in the intervention. They should involve partnerships between student or teacher-based organizations, community or industry organizations, universities, or educational research organizations.
3. Provide details about the evidentiary base that will be established to demonstrate, through rigorous, well-controlled, large-scale empirical studies, the impact of the proposed intervention on practice. Explain how plausible cause-and-effect assertions (between interventions and student learning, motivation, and achievement) will be tested. There must be a plausible set of studies capable of demonstrating whether or not the intervention had the intended effects.

Scale-up projects will range in duration from three to five years with an award size of up to $2.5 million (at $500,000 per year maximum). The size and duration of the request should be appropriate to the scope of the project.

D. ITEST Conferences and Workshops

A limited number of conferences and workshops will be funded with the express goal of defining the research agenda for ITEST studies and providing a better understanding of how to assess the impacts of ITEST interventions on student motivation to enter STEM careers. Conference and workshops proposals should:

1. Target STEM educators (from both formal and informal learning settings), educational researchers, and evaluators. The proposal narrative should clearly identify the participants and their contributions to the meeting. The goals and anticipated outcomes should be clearly stated.
2. Bring together experts with knowledge in technology and STEM education, career development, cognitive science, sociology, anthropology, science fields, and other fields that are invested in workforce issues. The issues related to STEM workforce interest, motivation, capacity, preparation and development are complex and research on this topic may draw on a range of disciplines.
3. Contribute to the development of a research agenda on K-12 STEM workforce preparation and development issues, workforce participation, and cyberlearning. What are the important questions and issues that should be addressed in studies of STEM workforce development and what types of designs are most suitable?
4. Identify robust evaluation approaches for studying the impact of innovative STEM and ICT workforce motivation, preparation, and development models. Conferences may also focus on evaluation design and instruments that will contribute to the knowledge base for studying STEM workforce development.
5. Present appropriate evaluation plans to assess the impact of the activities and success in meeting project goals.
6. Identify the intended audience and participant selection, in addition to providing a tentative agenda, list of speakers, promotion plan, description of post-conference products, and dissemination plans.

Conferences and workshops may be up to one year in duration with award sizes at most $250,000. The size and duration of the request should be appropriate to the scope of the project.

E. Expectations for All ITEST projects

Because the ITEST program will be involved in a set of interrelated program evaluations, all projects must include project-level evaluation plans. These plans should be for formative and summative evaluation that assess the impact of the project's activities, progress, and success in meeting goals. An external evaluator who handles at least the summative evaluation is highly recommended.

Evaluations of ***strategies*** and ***scale-up*** projects must (1) include a clear presentation of the questions that will guide the evaluation, (2) specify indicators of impact on participants, (3) describe how the data will be collected, (4) explain the methods of analysis, (5) describe any basis for comparisons, and (6) provide the timeline for the evaluation process. If materials are developed as part of the intervention, appropriate plans for expert review and field-testing of materials should be included. In some cases the evaluation plans for ***strategies*** projects will be closely intertwined with plans to conduct research about the effects of the strategy on desired outcomes.

Research projects also must include evaluation plans appropriate to the goals of the research activity. These plans might include expert review at key stages of the project, development of indicators to assess the levels of rigor with which the research is implemented, or assessment of the scope and impact of the products of the research by an independent advisory committee.

Evaluative research designed and implemented by external evaluators will track the ITEST program's progress in meeting overall goals, as well as assess the overall impact on students, teachers, and the field, and potential effect on the ICT and STEM pipelines. All projects are expected to collaborate with the program evaluation and provide data and responses as requested.

The ITEST Resource Center (http://www2.edc.org/itestlrc/) provides technical assistance to ITEST grantees and collects project data to contribute to the existing repository of data on ITEST projects. All projects are expected to support the ITEST Resource Center's monitoring efforts to gather data, build models and disseminate findings.

F. Innovation through Institutional Integration (I^3)

Creativity, connectivity, integration, and synergy are keys to innovation and to developing human and institutional capacity to full potential. In both research and education, it is the forging of new links between ideas or methodologies that were previously disparate that frequently paves the way for innovation. When institutions optimize the benefits to be derived from the creative integration of intellectual perspectives or related domains of work, they create important opportunities for making progress on some of the most important scientific, technological, and educational challenges of our time. On individual campuses across the nation, for example, significant synergistic potential can be ignited when scholars and educators in related disciplines work together. Similarly, NSF awardees can harness new synergies by working together with other NSF-funded projects on their own campus or in close geographic proximity. When the results of these synergies are both compatible with and beneficial for the institution(s) involved, successful innovation can be created. Past efforts at integration have shown that opportunities for synergy can be created most successfully when collaborative projects include:

- Clear support from senior administrators;
- A cogent plan of action that includes expectations and staff development;
- Open cross-institutional dialogue that is supported and encouraged;
- A common campus-wide vision and value system that stresses the importance of synergistic efforts;
- The formation of a campus network with a set of individuals who take ownership and provide leadership for the initiative.

The campus network is an important aspect of successful collaboration at every stage of development and is critical to the sustainability and enhancement of created partnerships as well as the institutionalization of new innovations. This network can (a) foster communication across the campus to encourage the formation and dissemination of new ideas, values, and learning; (b) serve as a source of leadership to promote and carry out integrative activities; and (c) develop and sustain existing connections while continually expanding collaborative efforts.

Innovation through Institutional Integration (I^3) challenges faculty, administrators, and others in institutions to think strategically about the creative integration of NSF-funded awards towards a whole that exceeds the sum of its parts. Although there is particular emphasis in I^3 on awards managed by programs in the Directorate for Education and Human Resources (EHR), institutional integration is not limited only to EHR awards but can include other NSF awards with a STEM educational focus. Two or more institutions in geographic proximity might, for example, partner to bridge existing NSF-funded awards on their campuses (e.g., RDE, IGERT, LSAMP, ATE, CREST, REU) to broaden participation in STEM fields and enhance undergraduate research opportunities. Additional connections might be made internationally with faculty or students outside the United States who would add their considerable intellectual and cultural perspectives. As another example, an institution might implement new policies, procedures, or mechanisms that encourage and value synergistic efforts among existing NSF-funded awards (e.g., GK-12, MSP, Noyce, REESE, DRK-12) and with other institutional units to better understand and enhance seamlessness across critical educational junctures, perhaps infusing innovative approaches to cyber-learning.

This effort has the following interrelated goals:

- Increase synergy and collaboration across NSF-funded projects and within/between institutions, towards an educational environment where artificial boundaries are significantly reduced and the student experience is more fully integrated;
- Expand and deepen the impact of NSF-funded projects and enhance their sustainability;
- Provide additional avenues to broaden participation through workforce development, especially for those underrepresented in STEM research and education; attend to seamless transitions across critical educational junctures; and/or provide more effectively for a globally engaged workforce;
- Promote innovative programming, policies, and practices to encourage the integration of STEM research and education; and
- Encourage STEM educational or related research in domains that hold promise for promoting intra- or inter-institutional integration and broader impacts.

Proposals that facilitate either (a) inter-institutional or (b) intra-institutional efforts are encouraged. Proposals may be submitted by (a) a single institution to address intra-institutional goals only or (b) an institution acting on behalf of an institutional partnership to address inter-institutional goals.

Proposals are expected to incorporate a depth and quality of creative, coherent, and strategic actions that extend beyond commonplace approaches to normal institutional operations. Proposals may also be submitted for research on institutional integration or other closely related themes articulated in the goals above.

I^3 is a cross-divisional effort in the Directorate for Education and Human Resources (EHR). For Fiscal Year 2009, proposals are being solicited in nine EHR programs that advance I^3 goals: CREST, GSE, HBCU-UP, ITEST, LSAMP, MSP, Noyce, RDE, and TCUP. All proposals submitted to I^3 through these programs have a common due date and will be reviewed in competition with one another.

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III. AWARD INFORMATION

Duration and Funding Level are all pending availability of funds for FY2009 and FY 2010: Research projects will be for up to three years in duration, with award sizes up to $1.5 million. Strategies projects will be for up to three years in duration, with award sizes at most $1.2 million. Scale-up projects will range from three to five years in duration, with award sizes at most $2.5 million. Conferences and Workshops projects will be for up to one year with awards up to $250,000. The requests should be appropriate to the duration and scope of the Research, Strategies, Scale-up, and Conference and Workshop project. Awards for Innovation through Institutional Integration (I3) projects will be made for durations of up to five years, with years four and five dependent on performance, in amounts of up to $ 250,000 per year, for a total of up to $ 1.25 million over 5 years, pending the availability of funds. I3 awards will be made as continuing grants.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

- ITEST: Only U.S. organizations located in the U.S. with an educational mission are eligible to apply; see the NSF Grant Proposal Guide (GPG) for further information.

  Eligibility for Innovation through Institutional Integration (I^3) is limited to institutions of higher education (including two- and four-year colleges) accredited in, and having a campus located in the US. If the proposal is exclusively for I^3 STEM educational or related research, then all categories of proposers identified in the NSF Grant Proposal Guide are eligible to submit.

PI Limit:

The Principal Investigator for an Innovation through Institutional Integration (I^3) proposal must be the university provost or equivalent chief academic officer, unless the proposal is exclusively for I^3 STEM educational or related research.

Limit on Number of Proposals per Organization:

There is no limit on the number of proposals per organization for ITEST.

For Fiscal Year 2009, proposals are being solicited in nine EHR programs that advance the goals of Innovation through Institutional Integration (I^3): CREST, GSE, HBCU-UP, ITEST, LSAMP, MSP, Noyce, RDE, and TCUP. Given the focus on institutional integration, an institution may submit only one proposal to the I^3 competition for each deadline.

Limit on Number of Proposals per PI:

An individual may serve as the Principal Investigator (PI) for no more than one Research, Strategies, or Scale-up proposal under this solicitation.

Innovation through Institutional Integration (I^3): no limit specified.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Letters of Intent*(required):*

Letters of Intent must be submitted via the NSF FastLane system, using the Letter of Intent module in FastLane, for ITEST ***Research***, ***Strategies***, and ***Scale-up*** projects only.

Letters of Intent are limited to 2,500 characters, including spaces (approximately 350 words). Your Letter of Intent should contain a brief narrative that describes the project and provides the following information: (1) a project title; (2) clear identification of the proposal component and the proposal category within that component--Research, Strategies, or Scale-up; (3) a list of proposed Principal Investigators and Co-Principal Investigators, including organizational affiliations and departments; (4) partnering institutions; (5) STEM disciplines represented and relationship to the STEM or ICT workforce; and (6) grade band, if applicable.

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 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.

Cover Sheet: The Cover Sheet must contain all requested information. Complete this form with the appropriate information and make sure to check the human subjects box when appropriate. If project funds are requested from another Federal agency or another NSF program, it must be indicated on the cover sheet. If such funds are requested subsequent to proposal submission, a letter should be sent to the attention of the ITEST program, identifying the proposal by its NSF number. In the title section on the cover sheet, begin each title with the type of ITEST proposal being submitted (e.g., Studies, Strategies, Scale-up, Conference, or I^3 for Innovation through Institutional Integration proposals).

To avoid delays in processing, it is also suggested that PIs begin the process of obtaining appropriate Institutional Review Board (IRB) approvals or exemptions as needed for projects involving human subjects.

ITEST Proposal Submission Instructions:

Project Summary: A one-page Project Summary should be prepared, suitable for public release, which presents a self-contained description of the activity that would result if the proposal were funded. The initial sentences must describe the ITEST program component to which the proposal is submitted (*Research, Strategies, Scale-up, or Conferences and Workshops). Research* projects must state the research questions to be explored, the design and instruments to be used, and plans for analysis and dissemination. *Strategies* projects must describe the STEM content emphases, the strategy to be designed, implemented, and tested, and the audiences to be involved. *Scale-up* projects must discuss the evidence collected from previous efforts with an innovation that justifies an expansion of the effort. C*onference and Workshop* proposals must describe the conference goals, target audience, conference products, and dissemination plan. For Research, Strategies, and Scale-up projects, the summary should indicate the STEM or IT-intensive workforce need being addressed, a statement of objectives, methods to be employed, and potential contribution to the understanding of STEM or IT-intensive workforce issues or the outcomes resulting from the project.

All summaries **must** specifically address the project's ***intellectual merit*** and ***broader impacts***. If the Summary does **not** specifically address **both** review criteria in separate statements, the proposal **will be returned without review**.

Project Description (maximum of 15 pages; including results from prior NSF support): The Project Description contains most of the information that determines whether a grant will be awarded. Competitive proposals respond fully to the ITEST program description in this solicitation. Reviewers will judge the merit of each proposal based on the content of the Project Description.

The narrative section of a competitive ITEST ***Research, Strategies, or Scale-up*** project should include the following:

- project overview
- project goals and objectives
- explanation of principles that guided the project design, informed by the literature
- detailed project description with a timeline
- qualifications of key personnel who will be coordinating the project
- anticipated results
- evaluation plan
- dissemination plan
- sustainability plan
- summary of results from prior support

Include a description of the responsibilities, qualifictions, and level of effort of the key personnel involved in the project, including the role of consultants and advisors at each stage of the project. Provide documentation of collaborative relationships and partnerships that are essential to the project, such as letters of support.

Evaluation: It is expected that ITEST projects will include, at a minimum, two stages of evaluation (formative and summative) at a level commensurate with the nature and scope of the propose project. Elements to be addressed in the Evaluation Plan of a proposal:

- The evaluation questions
- Strategies used for the various phases of the project
- General information about the evaluation processes including sample sizes, instruments used, nature of the data (quantitative and qualitative), and analytical methods
- Timeline: When, during the various phases of the project, evaluation work will take place; be sure to allot adequate time for all phases including an adequate and thorough summative evaluation
- Budget: The budget should be adequate to enable the evaluator to conduct a thorough project evaluation
- Name, credentials, and responsibilities of the evaluator(s)

Dissemination: Describe, as appropriate, how information about the project and any knowledge gained in developing the project will be conveyed to the field.

Timeline: Provide a detailed (e.g., quarterly) schedule for each year of the project that indicates the major developmental steps for all the aspects of the project.

Sustainability: Describe the plans to sustain the project efforts beyond the period of the grant, as appropriate.

Results from Prior Support: If the prospective PI or co-PIs received support for related NSF activities within the past five years, a description of the project(s) and outcomes must be provided in sufficient detail to enable reviewers to assess the value of results achieved. Past projects should be identified by NSF award number, funding amount, period of support, title, summary of results, and a list of publications and formal presentations that acknowledge the NSF award (do not submit copies of the latter). Evaluation data should be clearly described. Details regarding evaluation data should be included in the Supplementary Documentation. PIs and co-PIs with overdue Final Reports on previous NSF awards (not submitted within 90 days after previous NSF awards expired) may not receive any new grants until those Final Reports have been submitted.

Other sections (in addition to the 15 page narrative):

References Cited: Any literature cited should be specifically related to the proposed project, and the Project Description should make clear how each reference has played a role in the motivation for, or design of, the project.

Biographical Sketches: Biographical information (no more than two pages each) must be provided for each senior person listed on the budget forms, including consultants, and advisors. Include career and academic credentials, as well as e-mail and mailing

address.

Special Information/Supplementary Documentation: The only items permitted in the Supplementary information section are the LOI confirmation receipt, letters of support from project partners, and evaluation results from prior support. The first page should be your LOI confirmation receipt from FastLane which shows the LOI ID, title, PI name, and submission date.

Appendix: Not permitted. The 15 page Project Description should contain all of the information needed to describe the projects. Proposals submitted with an Appendix will be returned without review.

FOR INNOVATION THROUGH INSTITUTIONAL INTEGRATION (I^3) PROJECTS

The proposal should articulate the project's vision, goals, and anticipated outcomes and describe how the project will achieve them. The proposal should draw on the existing, relevant base of literature and articulate how the plan of work is so informed. It is expected that implementation of the plan of work will impact participating NSF awards, as well as other relevant parts of the institution(s). The proposal should, therefore, address how the goals of the overall project are compatible with the goals of the individual integrated components, as well as how the project is both compatible with and beneficial for the host institution(s). The proposal should include a management/governance plan that describes who is responsible for what, a timeline, and an evaluation plan. All proposals must clearly demonstrate that the submitting team has the capability to manage the project, organize the work, and meet deadlines.

Each proposed implementation project in Innovation through Institutional Integration (I^3) should have an evaluation plan to assess progress and success in meeting project goals and objectives. An independent, external project-level evaluation is to be conducted to inform the institution and others of the progress and findings of the grant activities, especially those that address the project's synergistic activity (i.e., the value added by I^3). I^3 projects are expected to have baseline data, establish measurable targets, and collect evidence to determine annual progress and long-term outcomes. If applicable, it is highly desirable to establish a systematic plan to track student participants beyond their involvement in the project. Project-level evaluation should be designed to offer feedback for strengthening implementation over the course of the project, provide credible evidence to justify continued investment in the project, and report results (and describe models/paradigms) of institutional and/or disciplinary changes associated with the investment strategy.

Each I^3 project, as part of a national effort, is expected to cooperate in the monitoring and independent portfolio evaluation efforts conducted by NSF's contracted evaluators. While each project will propose its own types of specific qualitative and quantitative measures, some later standardization of performance monitoring is anticipated so that NSF can conduct a summative/impact evaluation. The I^3 portfolio (summative/impact) evaluation will be designed to determine how effectively I^3 is contributing to the knowledge base, building a community of innovators, strengthening/advancing the higher education STEM infrastructure, and promoting collaborations that advance the goals of I^3.

Proposals for research must address one or more I^3 goals and discuss the current state of knowledge relevant to the project. This brief literature review should clearly inform the proposed research. The project description should identify the methods the project will use and explain why those methods are appropriate to the questions that the proposal addresses. Methodologies must be matched with strategic research questions, and the logic among research question, method, analysis, inference, and evidence should be well articulated.

The results of prior, relevant NSF investment(s), ***especially projects on which the proposed institutional integration is based***, are to be described and supported by data, along with a discussion of both successes and failures. The proposal should also clearly indicate how the intended work differs from, builds on, or is otherwise informed by prior efforts.

Proposers are reminded to identify the program solicitation number (NSF 09-605) 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:

Additional limitations to consider include the following:

Major research equipment purchases are not supported. Personal and laptop computers, servers, and other hardware, may not be purchased under ITEST projects. Software, probes, and general equipment needed to implement the ITEST program is permitted.

C. Due Dates

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

  January 12, 2009

  ITEST

  January 19, 2010

  ITEST

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

  February 20, 2009

  ITEST

  February 24, 2009

Innovation through Institutional Integration (I^3)

August 25, 2009

Innovation through Institutional Integration (I^3)

February 12, 2010

ITEST

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 addition to the two NSF criteria for Intellectual Merit and Broader Impacts, special review criteria for Innovation through Institutional Integration (I^3) implementation projects are:

- The extent to which the proposed project addresses the interrelated goals for institutional integration and adds value to existing NSF awards.
- The extent to which there is a demonstrated track record of success for the existing NSF awards on which the proposed institutional integration is based.
- The degree of innovation in the proposed project as evidenced by a depth and quality of creative, coherent, and strategic actions that extend beyond commonplace approaches to normal institutional operations.
- The extent to which the proposed project addresses programming, policies, and practices commensurate with the sustained institutional change needed to seed and nurture appropriate, synergistic relationships among discrete NSF awards.

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.

Additional reporting requirements may be included, e.g., to support program evaluation, as required.

VIII. AGENCY CONTACTS

General inquiries regarding this program should be made to:

- Address questions to, telephone: (703) 292-8628, email: DRLITEST@nsf.gov
- Julia V. Clark, ITEST co-lead, telephone: (703) 292-5119, email: jclark@nsf.gov
- Sylvia M. James, ITEST co-lead, telephone: (703) 292-5333, email: sjames@nsf.gov
- Larry E. Suter, ITEST co-lead, telephone: (703) 292-5144, email: lsuter@nsf.gov

For questions related to the use of FastLane, contact:

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