Innovative Technology Experiences for Students and Teachers (ITEST)

Program Solicitation

NSF 08-526

Replaces Document(s):

NSF 07-514

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)***:***

February 15, 2008

for ITEST only

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

April 10, 2008

for Innovation through Institutional Integration (I^3)

April 11, 2008

for ITEST

REVISION NOTES

In furtherance of the President's Management Agenda, NSF has identified programs that will offer proposers the option to utilize Grants.gov to prepare and submit proposals, or will require that proposers utilize Grants.gov to prepare and submit proposals. Grants.gov provides a single Government-wide portal for finding and applying for Federal grants online.

In response to this program solicitation, proposers may opt to submit proposals via Grants.gov or via the NSF FastLane system. In determining which method to utilize in the electronic preparation and submission of the proposal, please note the following:

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

A realignment in NSF's Directorate for Education and Human Resources (EHR) has merged the Division of Research, Evaluation, and Communication (REC) and the Division of Elementary, Secondary, and Informal Education (ESIE) into a new division, the Division of Research on Learning in Formal and Informal Settings (DRL). This revision reflects efforts to increase coordination and coherence across the DRL programs. The revision of the Information Technology Experiences for Students and Teachers (ITEST) solicitation to the Innovative Technology Experiences for Students and Teachers (ITEST) represents a restructuring of efforts to meet the demand for qualified STEM, including information technology workers; to

diversify the workforce since women and minorities are underrepresented in Information and Communication Technology (ICT) and other STEM fields; and to produce research addressing STEM workforce issues.

ITEST will support three types of projects as standard or continuing grants - Strategies, Scale-up, and Studies - that replace the 4 previous components: youth-based projects, comprehensive projects, traditional project renewals, and the ITEST resource center. The types of projects that will be supported are:

Workforce Development ***Strategies projects***, to design, implement and test theory and practice-based models intended to interest and prepare students to participate in the STEM workforce, especially information technology, of the future.

Workforce Development ***Scale-up projects***, to implement and study models designed to prepare students for the STEM workforce, especially in information and communication technology fields, in a large-scale setting such as a state or at the national level, based on evidence of demonstrated success of the model in local settings.

Workforce Development ***Studies projects***, to build a general knowledge base by conducting research on the educational challenges associated with STEM workforce capacity, quantity, and career trajectories, especially in information and communication technology fields.

A new track for *Innovation through Institutional Integration* (*I*^{3}) has been added. I^3 challenges 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 2008, proposals are being solicited in six EHR programs that advance I^3 goals: CREST, ITEST, 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. Awards will be made to institutions of higher education (including two-and four-year colleges). Given the focus on institutional integration, an institution may submit only one proposal to the I^3 competition in only one program.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Innovative Technology Experiences for Students and Teachers (ITEST)

Synopsis of Program:

What does it take to effectively interest and prepare students as participants 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 workforce in STEM, particularly in STEM-related information and communication technology (ICT) areas? How do they acquire them? 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?

The program responds to current concerns and projections about shortages of STEM professionals and information technology workers in the United States and seeks solutions to help ensure the breadth and depth of the STEM workforce. ITEST supports the development, implementation, testing and scale-up of models, as well as research studies to address these questions and to find solutions. There are a variety of possible approaches to improving the STEM workforce and to building students' capacity to participate in it. NSF seeks to expand the existing ITEST portfolio by addressing students at any age for grades kindergarten through high school and by including all areas of the STEM workforce, while retaining an emphasis on technology-related areas.

This ITEST announcement extends the previous ITEST announcement by placing greater emphasis on capturing and establishing a reliable knowledge base about the dispositions toward and knowledge about STEM workforce skills among U.S. students. The previous awards by the ITEST program have established a strong foundation upon which to enlarge a scientific basis for educational programs in STEM education.

Three types of projects are invited. ***Strategies*** projects will include the design, implementation, and evaluation of models for classroom, after-school, summer, virtual, and/or year-round learning experiences for students and/or teachers to encourage students' readiness for, and their interest and participation in, the

STEM workforce. ***Scale-up* projects** would implement and test models about preparing students for information technology or the STEM workforce in a large-scale setting such as a state or national level based on evidence of demonstrated success. ***Studies*** projects are research projects to enrich understanding of issues related to enlarging the STEM workforce, including efficacy and effectiveness studies of intervention models, longitudinal studies of efforts to engage students in the STEM areas, development of instruments to reliably and validly assess engagement, persistence, and other relevant constructs, or studies to identify predictors of student inclination to pursue STEM career trajectories. NSF is especially interested in projects that target students who are underserved and underrepresented in STEM ICT-intensive careers, including those residing in rural and economically disadvantaged communities.

Innovation through Institutional Integration (I^3) projects enable 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 2008, proposals are being solicited in six EHR programs that advance I^3 goals: CREST, ITEST, 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: 20 to 36 depending on the availability of funds. It is anticipated that about 15-22 Strategies awards, 1-4 Scale-up awards, and 4-10 Studies awards will be made. For the Innovation through Institutional Integration (I^3) competition, up to 10 awards in this cross-divisional effort will be made.

Anticipated Funding Amount: $32,000,000 for new Innovative Technology Experiences for Students and Teachers (ITEST) projects in FY 2008 pending availability of funds. $10,000,000 over 5 years for Innovation through Institutional Integration (I^3) projects which are being requested across multiple EHR programs, pending availability of funds.

Eligibility Information

Organization Limit:

Proposals may only be submitted by the following:

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

  Eligibility for Innovation through Institutional Integration (I^3) is limited to institutions of higher education (including two- and four-year colleges) located and accredited in the US, acting on behalf of their faculty members.

PI Limit:

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

Limit on Number of Proposals per Organization: 1

Innovation through Institutional Integration (I^3): For Fiscal Year 2008, proposals are being solicited in six EHR programs that advance I^3 goals: CREST, ITEST, MSP, Noyce, RDE, and TCUP. Given the focus on institutional integration, an institution may submit only one proposal to the I^3 competition in only one program.

Limit on Number of Proposals per PI: 1

An individual may serve as the Principal Investigator (PI) for no more than one proposal under this solicitation.

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

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)***:***

  February 15, 2008

  for ITEST only

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

  April 10, 2008

  for Innovation through Institutional Integration (I^3)

  April 11, 2008

  for ITEST

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

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. EHR promotes four goals in fulfilling this responsibility:

1. To prepare the next generation of STEM professionals and attract more U.S. citizens and permanent residents to these fields.
2. Increase the technological and scientific literacy of all U.S. citizens and residents so that they can participate responsibly in an increasingly technological society and acquire STEM knowledge that is appropriate to the development of workforce skills and life-long career opportunities.
3. To broaden participation of all groups and increase their achievement in STEM.

4. To attend to critical workforce needs requiring significant mathematics and science skills and knowledge, by attracting new people to these STEM fields and by providing support for the development of the current workforce.

To reach these goals, EHR 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 improve the effectiveness of STEM learning for people of all ages. Its mission includes promoting innovative research, development, and evaluation of learning and teaching across all STEM disciplines by advancing cutting-edge knowledge and practices in both formal and informal learning settings. DRL also promotes the broadening and deepening of capacity and impact in the educational sciences by encouraging the participation of scientists, engineers, and educators from the range of disciplines represented at NSF. Therefore, DRL's role in the larger context of Federal support for education research and evaluation is to be a catalyst for change—advancing theory, methods, measurement, development, and application in STEM education. The Division seeks to advance 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, tools, and human capacity needed to bring about the needed transformation of STEM education for the 21st century.

Because NSF is the premier Federal agency supporting basic research at the frontiers of discovery in the sciences and engineering, DRL takes as a central principle that new and emerging areas of science and engineering must figure prominently into efforts to improve STEM education at all levels and in all settings. Hence its programs should reflect this through the integration of cutting-edge STEM content and the engagement of STEM researchers in all DRL initiatives.

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

- The Innovative Technology Experiences for Students and Teachers (ITEST) program is intended to enhance participation in the U.S. STEM and ICT-intensive workforce, through the design, implementation, scale-up and testing of strategies for students and/or teachers, and through research studies that deepen understanding of issues related to STEM workforce participation.
- The Discovery Research K-12 (DR K-12) program seeks to enable significant advances in K-12 student and teacher learning of the STEM disciplines through the research and development of innovative resources, models, and technologies for use by students, teachers, and policy makers.
- The Informal Science Education (ISE) program builds on educational research and practice and seeks to increase interest, engagement, and understanding of STEM by individuals of all ages and backgrounds through self-directed STEM learning experiences.
- The Research and Evaluation on Education in Science and Engineering (REESE) program aims at advancing research at the frontiers of STEM learning, education, and evaluation and to provide the foundation of knowledge necessary to improve STEM teaching and learning at all educational levels and in all settings.

Each of these DRL 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 science and engineering workforce, expanding the scientific literacy of all citizens, and promoting research that advances the frontiers of knowledge.

EHR's focus on *Innovation through Institutional Integration* is an additional focus that challenges institutions to think strategically about the creative integration of NSF-funded awards towards a whole that exceeds the sum of its parts.

The major distinction between ITEST and other DRL programs (ISE, DR-K12, REESE) is that ITEST focuses specifically 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. A key focus in ITEST is how motivation relates to preparation and participation.

ISE focuses on *self-directed STEM learning experiences* that increase interest, engagement, and understanding of STEM in public and professional audiences (e.g. informal science educators, researchers, evaluators, and exhibit developers; producers and directors of science education radio, TV and large format films). DR-K12 focuses specifically on issues of *K-12 learning* and projects will involve a *substantial development component* – the **design** and **implement** components.

REESE focuses primarily on *building theory and knowledge through research and evaluation*, across learning contexts and ages – the **study** and **evaluate** components in the cycle (see Figure 1). The outcomes of ITEST, ISE, DR K-12 projects will be resources, models, or technologies that are grounded in research and practice, as well as research findings about the implementation and impact of ICT and STEM education resources, models, and technologies. The primary outcomes of REESE projects will be research findings, methods, and theoretical perspectives.

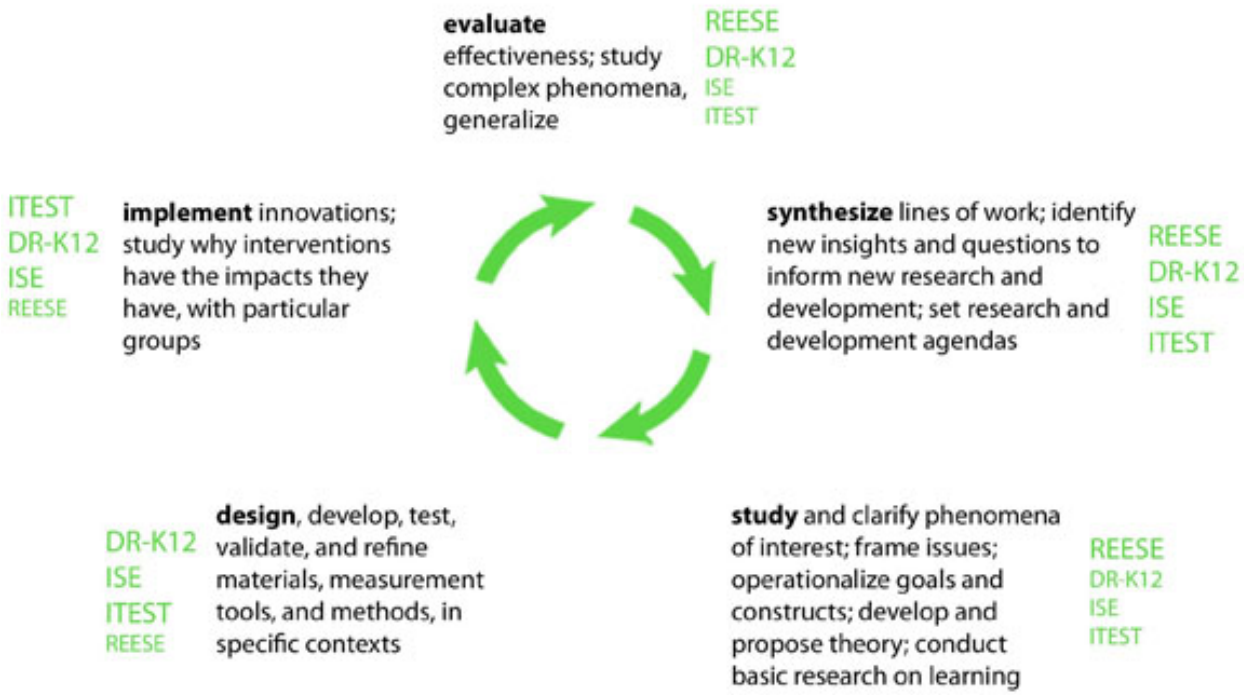

Figure 1. **DRL Cycle of Innovation and Learning**
(Note: Programs whose primary emphases relate to particular components appear in larger type.)

All research and development activities within DRL aim at generating knowledge, informing practitioners, 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 EHR, 2005). All DRL programs are concerned with all five components of the cycle, to different degrees. Programs whose primary emphases relate to particular components appear in larger type.

Each part of the cycle, represented by the activities of DRL's programs, forms the vital and compelling foundation for advancement of the others. From challenging the STEM educational and research communities with innovative ideas, to conducting the pioneering and pragmatic research necessary to advance those goals, to developing world-class instructional materials and resources for teachers to advance their knowledge of STEM teaching and learning, to engaging all citizens and residents of the United States in learning and as future ICT workers and scientists and engineers, DRL is providing the ideas, resources, and human capacity to advance STEM learning and education in the 21st Century.

About ITEST

Goals: The *National Science Foundation Investing in America's Future Strategic Plan FY 2006-2011* has as a Learning Goal: **Cultivate a world-class and broadly inclusive science and engineering workforce,** and expand the scientific literacy of all citizens. The ITEST program addresses the first part of this goal directly. The goals of NSF's Innovative Technology Experiences for Students and Teachers (ITEST) program are:

- To develop, implement, study and evaluate strategies that encourage K-12 students to be intellectually prepared for careers in information technology and STEM fields and to consider careers in those fields.
- To develop strategies that equip teachers with the resources to ensure that their students consider and are prepared for choosing to enter the STEM workforce.
- To produce research tools and research findings that build the knowledge base about approaches, models, and interventions with K-12 aged children and teachers that are most likely to increase United States capacity in the STEM workforce, including ICT fields.

Definition of Eligible Areas: The ITEST program is funded by H-1B visa revenues in direct response to the need to ensure a high-quality STEM workforce that can meet future technology needs in the U.S. For the purposes of ITEST the "STEM workforce" is defined broadly, to include technologists, scientists, engineers, and mathematicians. ITEST proposals may focus on any STEM area paying particular attention to how their projects would address specific needs of the future U.S. workforce with K-12 students, their teachers or their parents.

The recent growth of occupations that are ICT-intensive (e.g., computational biology, biotechnology, and nanotechnology) is expected to continue. For example, the U.S. Department of Labor identified information technology as "the fastest growing sector in the economy with a 68% increase in output growth rate projected between 2002 and 2012" (http://www.bls.gov/news.release/ecopro.t02.htm) and all of the fastest-growing occupations demand highly developed skills in the use of modern technology. The professional fields include computer and information scientists, hardware and software engineers, and experts in communication networks, technology interfaces and human-computer interfaces. These occupations often demand knowledge of powerful and shared computing resources, of developing and using large databases and visualization tools, and of designing robust communications for access, sharing, and collaboration.

More generally, investigators may identify other established and emerging STEM fields and areas of focus and make appropriate arguments for why building strategies and studies within those areas is likely to have fruitful yield for the development of innovation and capacity in the STEM and ICT-intensive workforce. In addition to technical and STEM content, 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).

ITEST invests in three types of projects. ***Strategies*** projects will include the design, implementation, and evaluation of models for classroom, after-school, summer, virtual, and/or year-round learning experiences for students and/or teachers to encourage students' readiness and motivation for, and their interest and participation in, the STEM, and especially ICT, workforce. These projects are intended to accomplish the first two ITEST goals and are intended to address the questions, "What is necessary to interest and prepare students as participants 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 workforce in STEM, and how do they acquire them?"

Scale-up projects will implement and test models about preparing students for information technology-intensive and STEM workforce careers in a large-scale setting such as a state or national level based on evidence of demonstrated success. These projects will be based on evidence drawn from previous projects or related theoretical and empirical evidence and will provide new evidence of the feasibility or impact of implementing the models on a broader scale. These projects address the question of whether models and programs that have proven to be effective locally can be extended to wider implementation.

Studies projects will be research projects to enrich understanding of issues related to enlarging the STEM workforce, including efficacy and effectiveness studies of intervention models, longitudinal studies of efforts to engage students in the STEM, or especially ICT, areas, development of instruments to reliably and validly assess engagement, persistence, and other relevant constructs, or studies to identify predictors of student inclination to pursue STEM and/or ICT career trajectories. ***Studies*** projects are intended to accomplish the third ITEST goal, and address the questions, "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?"

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 especially 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 is tapping 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 those residing in rural and economically disadvantaged communities.

Innovation through Institutional Integration (I^3) projects enable 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 2008, proposals are being solicited in six EHR programs that advance I^3 goals: CREST, ITEST, MSP, Noyce, RDE, and TCUP.

II. PROGRAM DESCRIPTION

ITEST will support three types of projects as standard or continuing grants - Strategies, Scale-up, and Studies - that replace the 4 previous components: youth-based projects, comprehensive projects, traditional project renewals, and the ITEST resource center.

A. ITEST ***Strategies*** projects

The goal of ITEST *Strategies* projects is to develop, implement and study strategies that encourage K-12 students to be prepared for and to consider careers in the STEM fields, especially ICT-intensive fields, and/or that equip teachers with the resources to ensure that their students consider and are prepared for

choosing to enter the STEM workforce. Or, 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, especially ICT fields, or their motivation to consider such career areas.

Projects in this category are guided by the following questions:

- What strategies will best support student development for productive participation in the STEM, especially ICT-intensive, 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?
- What strategies can parents and caregivers adopt in the modern digital and computer age that develop student understanding of and appreciation for the scientific 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, or for identifying and building knowledge, skills, and dispositions that are essential for participation in that workforce. We invite a range of types of strategies and models. Any strategy proposal must directly impact K-12 students or K-12 teachers and must involve a partnership among different types of institutions.

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

Student involvement could be of 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. We strongly encourage innovative strategies with the potential to transform STEM learning in support of workforce development.

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, or STEM workplace demands; or make a case on the basis of evidence from experience and professional judgment, or other relevant theory or arguments that support the strategy. For instance, if the strategy is to ?help teachers of science ensure that their students have opportunities to engage in creative design activities?, then 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 STEM and workforce skills. 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 describe in detail the nature of the after-school experience that will be built, what materials will be produced, and how the design will be rigorous and systematic. Or, 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.
4. 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, describe in detail results of efficacy studies that provide indication of the promise of the strategy in new conditions. For instance, perhaps a project might adapt a local program that has sought talented students to address specifically the needs of youth from groups traditionally underrepresented in STEM education and encourage their participation in advanced high school STEM courses**.**
5. Explain the immediate and longer-term outcomes that are anticipated, and describe how these outcomes are related to the strategy. Provide detail about how the progress toward the goals will be measured, including what instruments and research or evaluation design that will be used. How will the process demonstrate the impact of the model, and the viability and potential of the strategy? We seek innovative and novel strategies, and realize that not all strategies will lead to the intended goals. 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 will enable building the knowledge base about what it takes to enhance the STEM workforce. A major contribution of the strategies projects should be to provide evidence for this knowledge base.

Strategies projects will be up to three years in duration, with award sizes at most $1.5 million. The request should be appropriate to the duration and scope of the project.

B. **ITEST Scale-up Projects**

The goal of *ITEST* ***Scale-up*** projects is to apply strategies to enhance student or teacher knowledge of and disposition toward STEM, and especially ICT, careers to larger numbers of participants, broader geographic areas or to a wider range of activities than had been attempted previously. The projects shall provide clear evidence that previously enacted strategies showed promise on the basis of research and evaluation studies.

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). The scale-up of an educational innovation may involve scaling up ideas (e.g. a project may broaden an original conceptual focus of an innovation) or the scope of implementation (e.g. a project might propose how to obtain quantitative change in the number and types of people involved, such as by broadening the innovation to new geographic areas), or both. **Scale-up** proposals shall provide systematic evidence that the proposed innovation with teachers, students, or parents has been previously implemented in some context and that the new work would broaden it to new settings.

Projects in this category are guided by the following questions:

- Can innovative strategies for supporting K-12 students' development for productive participation in the STEM workforce of the future that have been shown to be effective be applied to new settings?
- What evidence can be created 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?

If the strategy has been implemented previously, describe in detail the results of efficacy studies that provide evidence for the promise of the strategy in limited conditions.

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 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, or for identifying and building knowledge, skills, and dispositions that are essential for participation in that workforce.

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, etc.). 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.
2. Describe the plan for implementing the scaled-up version, including population and participants. The interventions may be school-based or based outside of school and should use technology either in the intervention or its analysis. They should involve partners between student or teacher-based organizations and community or industry 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) may be tested. There must be a plausible set of studies showing whether or not the intervention was successful.

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 request should be appropriate to the duration and scope of the project.

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

C. ITEST ***Studies*** projects

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

There is much that we do not understand about effective strategies for engaging youth 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 cross-cutting projects that bring together researchers in technology and STEM education, career development, psychology, sociology, anthropology, science fields, and other communities that are invested in workforce development. A broad range of study designs is encouraged including exploratory, evaluative, experimental, quasi-experimental, and ethnographic descriptive.

Projects in this category are guided by the following questions:

- What educational activities would increase the nation's capacity to participate in transformative, innovative STEM advances?
- How can we assess and predict inclination to participate in the STEM fields?
- How can we measure and study impact of various models to encourage that participation?

Studies projects are research projects to build a knowledge base about the specific challenges of ensuring that the STEM, especially ICT-intensive, workforce is adequate and has the capacity to advance science and technology in the nation in the coming years. These three 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. Over the last five years, the ITEST program has funded a broad array of innovative models for teacher professional development designed to increase the ability of educators to integrate ICT technology into STEM courses, as well as year-round youth programs that foster engagement in ICT in non-school settings. Research studies to examine the effectiveness of these and other interventions and strategies for ICT workforce growth are eligible.

ITEST supports research projects designed to improve the understanding of factors that increase the STEM, especially ICT-intensive, workforce. We invite 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. We expect that ITEST ***studies*** projects will identify critical new 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, especially ICT, career paths.

Relevant research questions include but are not limited to:

What factors sustain students' interest in STEM and/or ICT-intensive 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?

Because ITEST supports projects in a variety of learning settings, understanding the transference of skills and knowledge from out-of-school to classroom settings and vice versa is also of interest, as are career trajectories within particular STEM fields, particularly emphasis areas such as ICT 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.

Studies 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 this question will help to build the knowledge base about how K-12 students and teachers can become engaged in building STEM,

especially IT-intensive, 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 STEM and/or IT-intensive education as appropriate.

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, especially IT-related, 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 rigorous to the particular questions being pursued. Describe any instruments or measures that will be used or developed, and address issues of reliability and validity. ITEST does not prescribe any particular methodology or design, but rather seeks innovative designs that will permit exploration of the research questions. Because of the pressing need to understand how to best build the STEM, especially IT-intensive, workforce, and particularly the information technology workforce, the program is interested in studies that will produce causal claims about the relative impact of different strategies or approaches to interesting students in STEM careers. In addition, we invite studies to advance methodology for longitudinal work, to produce instruments, or to develop theoretical constructs. The proposal must clearly describe the research design including the methods, sample, instruments, data collection protocol, and analysis. If validity and reliability of measures are not available at the time of submission, the proposal must indicate how and when they will be obtained.
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 in the K-12 community who can use research as a basis for improving STEM education with an eye toward building workforce capacity.
6. Describe the nature of expertise needed to conduct the research and how the research team has that expertise.

Studies **projects** are intended to build and enrich the knowledge base about how and why K-12 students enter the STEM workforce, particularly in high need areas. Eventually this knowledge base should provide specific useful guidance for the most cost effective and powerful intervention strategies to build the workforce.

Studies projects may be up to three years in duration with award sizes at most $1.5 million. The request should be appropriate to the duration and scope of the project.

D. ***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 to 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.

Innovation through Institutional Integration challenges 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., IGERT, LSAMP, RDE, 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, ITEST, 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 footprints of NSF-funded projects and enhance their sustainability;
- Promote innovative programming, policies, and practices to encourage the integration of STEM research and education;
- Provide additional avenues to broaden participation by those underserved in STEM research and education, especially underrepresented minorities, women, and people with disabilities; attend to seamless transitions across critical educational junctures; and/or provide more effectively for a globally engaged workforce.
- Encourage STEM educational or related research in domains that hold promise for promoting intra- or inter-institutional integration and broader impacts.

Excellence or its potential exists everywhere, throughout the nation and in all types and sizes of institutions of higher education. 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, commensurate with the goals above.

Innovation through Institutional Integration (*I*^{3}) is a cross-divisional effort in the Directorate for Education and Human Resources (EHR). For Fiscal Year 2008, proposals are being solicited in six EHR programs that advance I^3 goals: CREST, ITEST, 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.

E. **Expectations for All ITEST projects**

1. **All ITEST projects** must demonstrate evidence of partnerships and collaboration in the formulation, implementation, and/or interpretation and dissemination of the project. Public and private partnerships can enhance resources and opportunities for exposure to careers in science and technology for ***strategies*** and ***scale-up*** projects [collaborations can bring important dimensions to the formulation of relevant research questions and issues in the ***studies*** projects]. Partnerships can provide opportunities for career exploration and mentoring, interactions with STEM professionals, and sites for learning about workplace applications of STEM knowledge and skills. We expect that the lead organization and/or partners in ***strategies*** and ***scale-up*** will include two-year colleges, universities, research organizations, technology-based businesses, industry-based laboratories, informal science education institutions, or community-based organizations, as appropriate, to provide content expertise, and research experiences for participants. They also provide context, data, and experiences for researchers.
2. The ITEST program will be involved in a set of interrelated program evaluations, and all projects must include project-level evaluation plans. These plans should be for formative and summative evaluation to 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) develop indicators of impact on participants, (3) describe how the data will be collected, (4) explain methods of analysis, (5) describe any basis for comparisons, and (6) provide the timeline for the evaluation process. If materials are developed, 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 study and test the strategy.

Studies 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, and 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.

There will be a third-party ITEST evaluative research plan designed and implemented by external evaluator (s) to track the program's progress in meeting overall goals and to 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.

In addition, an award has been made to the ITEST Resource Center (http://www2.edc.org/itestlrc/) to

provide technical assistance and contribute to the existing repository of data on ITEST projects, and all projects are expected to work with the ITEST Resource Center.

References

American Statistical Association (2007). *Using statistics effectively in mathematics education research.* Retrieved July 9, 2007 from http://www.amstat.org/research_grants/pdfs/SMERReport.pdf.

National Science Board (2007). *Enhancing Support of Transformative Research at the National Science Foundation, NSB-07-32.* Retrieved November 15, 2007 from http://www.nsf.gov/nsb/documents/2007/tr_report.pdf

National Science Foundation (2005). *The mathematics education portfolio brief*, (NSF 05-03). Retrieved July 9, 2007 http://www.nsf.gov/pubs/2005/nsf0503/nsf0503.pdf.

National Science Foundation (2006). *Investing in America?s Future Strategic Plan FY 2006-2011,* (NSF 06-48). Retrieved November 15, 2007 //http://www.nsf.gov/publications/pub_summ.jsp?ods_key=nsf0648.

RAND Mathematics Study Panel (2003). *Mathematical proficiency for all students: Toward a strategic research and development program in mathematics education.* (MR-1643.0-OERI) Santa Monica, CA: RAND.

Schneider, B., & McDonald, S-K (Eds.). (2007). *Scale-Up in Education, Volume 1: Ideas in Principle.* Lanham, MD: Rowman & Littlefield.

U.S. Department of Labor, Bureau of Labor Statistics (2004). *Employment by major occupational group (Table 2).* Retrieved November 7, 2007 http://www.bls.gov/news.release/ecopro.t02.htm.

U.S. Department of Labor (1991). *What work requires of schools: A SCANS report for America 2000.* Washington, DC: The Secretary's Commission on Achieving Necessary Skills. http://wdr.doleta.gov/SCANS/whatwork/whatwork.pdf

III. AWARD INFORMATION

Duration and Funding Level: Strategies projects will be for up to three years in duration, with award sizes at most $1.5 million. Approximately one-half of the program funds will be provided to Strategies projects. Scale-up projects will range from three to five years in duration, with award sizes at most $2.5 million. Approximately one-fourth of the program funds will be provided to Scale-up projects. Studies projects will be for up to three years in duration, with award sizes up to $1.5 million. Approximately one-fourth of the program funds will be provided to Studies projects. The requests should be appropriate to the duration and scope of the Strategies, Scale-up, and Studies 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 $ 200,000 per year, for a total of up to $ 1 million over five years. Innovation through Institutional Integration awards will be made as continuing grants.

IV. ELIGIBILITY INFORMATION

Organization Limit:

Proposals may only be submitted by the following:

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

  Eligibility for Innovation through Institutional Integration (I^3) is limited to institutions of higher education (including two- and four-year colleges) located and accredited in the US, acting on behalf of their faculty members.

PI Limit:

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

Limit on Number of Proposals per Organization: 1

Innovation through Institutional Integration (I^3): For Fiscal Year 2008, proposals are being solicited in six EHR programs that advance I^3 goals: CREST, ITEST, MSP, Noyce, RDE, and TCUP. Given the focus on institutional integration, an institution may submit only one proposal to the I^3 competition in only one program.

Limit on Number of Proposals per PI: 1

An individual may serve as the Principal Investigator (PI) for no more than one proposal under this solicitation.

Additional Eligibility Info:

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 *Strategies***, ***Scale-up*****,** and ***Studies*** projects **only.**

Letter of Intent Preparation Instructions:

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

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

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

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Grant Proposal Guide (GPG). The complete text of the GPG is available electronically on the NSF website at: http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Paper copies of the GPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.

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

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

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be

submitted via the NSF FastLane system. Chapter II, Section D.3 of the Grant Proposal Guide provides additional information on collaborative proposals.

Cover Sheet: The Cover Sheet must contain all requested information. Complete this form with the appropriate information and make sure to check the human subject 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 please begin each title with the type of ITEST proposal being submitted (e.g. **Strategies:** for Strategies proposals; **Scale-up:** for Scale-up projects; **Studies:** for Studies proposals, and ***I³*:** 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 Strategy, Scale-up Study* Submission Instructions:**

Project Summary: A one-page Project Summary should be prepared, suitable for publication, 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 (***Strategy, Scale-up,*** *or* ***Study). 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. ***Studies*** projects must state the research questions to be explored, the design and instruments to be used, and plans for analysis and dissemination. For ***Strategy, Scale-up***, and ***Studies*** 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*** in separate statements. If the Summary does **not** specifically address ***intellectual merit*** and ***broader impacts***, in separate statements, the proposal **will be returned without review**.

Project Description: (maximum 15 pages; including results from prior NSF support and data sheet). Most of the information that determines whether a grant will be awarded is included in the Project Description. Competitive ITEST proposals will include all information outlined in Section II. Reviewers will use this information in judging the merit of the proposal as described in this document.

The narrative section of a competitive ITEST ***Strategies, Scale-up***, or ***Studies*** project should include a project overview, project goals and objectives, a explanation of principles that guided the project design, a detailed project description, qualifications of key personnel who will be coordinating the project, anticipated results, and evaluation and dissemination plans. Provide a description of the responsibilities, qualifications, 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.

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

- Name, credentials, and responsibilities of the evaluator/s.
- Strategies used for the various phases of the project.
- The evaluation questions
- 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, will the evaluation work 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.

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 CoPI (s) 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 put into an appendix. PIs and CoPIs with overdue Final Reports on previous NSF awards (i.e., Final Reports not submitted within 90 days after those previous NSF awards expired) may not receive any new grants until those Final Reports have been submitted to NSF.

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) 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.

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. It is expected that the plan of work will impact participating NSF awards, as well as other relevant parts of the 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. The proposed evaluation plan should address the effectiveness of the strategies employed for institutional integration, including any institutional policies, practices, or mechanisms developed and implemented under this effort; and, as appropriate, provide for the evaluation of any products produced under this effort, as well as for the collection and analyses of data that track increases in STEM student recruitment and retention (against baseline data) and other measures of student progress (against comparable baseline data). In addition to project-level evaluation, awardees will be required to participate in an NSF data collection system (to be developed) that will track outcomes and impacts over time, as well as in an independent, multi-method program-level evaluation to assess the effectiveness of the ***I^3*** investment.

Proposals for I^3 research should 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 proposal must include a one-page Project Summary that briefly describes the project vision, goals, and work to be undertaken, as well as both NSF-approved merit review criteria (i.e., Intellectual Merit and Broader Impacts) in separate statements. If any Principal or co-Principal Investigator has received funding from NSF in the last five years, information on the prior award is required if relevant to the proposed scope of work. The results of prior, relevant NSF investment(s) should be clearly demonstrated 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.

Provide a biographical sketch for the Principal Investigator, co-Principal Investigators, and, as appropriate, Project Manager and Project Evaluator. Individual biographical sketches must not exceed two pages and may include a list of up to five publications most closely related to the proposed project. Also provide a Statement of Current and Pending Support for the Principal Investigator and co-Principal Investigators.

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)***:***

February 15, 2008

for ITEST only

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

April 10, 2008

for Innovation through Institutional Integration (I^3)

April 11, 2008

for ITEST

D. FastLane / Grants.gov Requirements

- **For Proposals Submitted Via FastLane:**

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

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.

- **For Proposals Submitted Via Grants.gov:**

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. The Grants.gov's Grant Community User Guide is a comprehensive reference document that provides technical information about Grants.gov. Proposers can download the User Guide as a Microsoft Word document or as a PDF document. The Grants.gov User Guide is available at: http://www.grants.gov/CustomerSupport. In addition, the NSF Grants.gov Application Guide provides additional technical guidance regarding preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

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

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program and, if they meet NSF proposal preparation requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF 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 with the proposer.

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.

NSF staff 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 I^3 are:

- The extent to which the proposed project addresses the interrelated goals for institutional integration;
- 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 date of receipt. 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 Federal Demonstration Partnership (FDP) 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/general_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from pubs@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.

For questions relating to Grants.gov contact:

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

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, MyNSF (formerly the Custom News Service) is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF Regional Grants Conferences. Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. MyNSF also is available on NSF's Website at http://www.nsf.gov/mynsf/.

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: pubs@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