

# Innovative Technology Experiences for Students and Teachers (ITEST)

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## PROGRAM SOLICITATION NSF 22-585

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**National Science Foundation**  
Directorate for Education and Human Resources  
Research on Learning in Formal and Informal Settings

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

August 12, 2022

August 11, 2023

August 09, 2024

## IMPORTANT INFORMATION AND REVISION NOTES

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### IMPORTANT INFORMATION

Innovating and migrating proposal preparation and submission capabilities from FastLane to Research.gov is part of the ongoing NSF information technology modernization efforts, as described in [Important Notice No. 147](#). In support of these efforts, full research proposals submitted in response to this program solicitation must be prepared and submitted via Research.gov. Proposals also may continue to be submitted via use of Grants.gov.

### REVISION NOTES

- ITEST Solicitation-Specific Review Criteria are required of all proposals.
- Required components for proposals in Section B of the Program Description are revised.
- Project types are revised.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 22-1](#)), which is effective for proposals submitted, or due, on or after October 4, 2021.

## SUMMARY OF PROGRAM REQUIREMENTS

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### General Information

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#### Program Title:

Innovative Technology Experiences for Students and Teachers (ITEST)

#### Synopsis of Program:

The economic prosperity and national security of the United States is reliant upon the nation's capacity to remain globally competitive in the technological and computational fields. The nation's competitiveness, however, is contingent upon its capacity to educate the next generation. Learning and teaching must be reimagined to better represent the diverse composition and perspective of our nation's people and be expanded to encompass all pathways for students to receive a high-quality STEM education. A highly proficient and diverse technological and computational STEM workforce is needed to advance new discoveries in science, engineering, and technology in the service of the nation. The ITEST program is one way NSF is responding to the challenge and opportunity to provide all students with equitable access to a STEM education related to the technical and scientific workforce.

ITEST is an applied research and development program with goals to advance the equitable and inclusive integration of technology in the learning and teaching of science, technology, engineering, or mathematics (STEM) from pre-kindergarten through high school. The program's objective is to support all students' acquisition of the foundational preparation in STEM disciplines. Preparation for the current and future workforce is increasingly dependent upon the application and use of technology and computing.

Proposed ITEST projects are expected to (1) engage students in technology-rich learning to develop disciplinary and/or transdisciplinary STEM content knowledge, including skills in data literacy and evidence-based decision-making and reasoning; (2) prioritize the full inclusion of groups who have been underrepresented and/or underserved, including but not limited to Blacks and African Americans, Alaska Natives, Hispanics and Latinos, Native Americans, Native Hawaiians, Native Pacific Islanders, persons with disabilities, neurodiverse students, and women in the STEM and information and communication technologies (ICT) workforce; (3) motivate students to pursue appropriate education pathways to technology-rich careers; and (4) leverage strategic and community partnerships to expand education pathways in communities through public and private partnerships and collaborations.

ITEST supports three types of projects: (1) Exploring Theory and Design Principles (ETD); (2) Developing and Testing Innovations (DTI); and (3) Scaling, Expanding, and Iterating Innovations (SEI). ITEST also supports Synthesis and Conference/Workshop proposals. ITEST will support one 5-year resource center starting in FY23. All ITEST proposals must address how the proposed research and development project meets the ITEST program Pillars: 1) Innovative Use of Technologies in Learning and Teaching, 2) Partnerships for Career and Workforce Preparation, and 3) Strategies for Equity in STEM Education (Program Description, section A.). All proposals must also include high-quality research design, a section describing how the project meets the Solicitation-Specific Review Criteria and plans for project evaluation and dissemination of findings (Program Description, section B: Requirements for Research Proposals.)

**Cognizant Program Officer(s):**

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

- Questions related to the Program, telephone: (703) 292-8620, email: [DRLITEST@nsf.gov](mailto:DRLITEST@nsf.gov)

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

- 47.076 --- Education and Human Resources

## Award Information

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**Anticipated Type of Award:** Standard Grant or Continuing Grant

**Estimated Number of Awards:** 24 to 33

ITEST expects to fund between 24 and 33 awards per year depending on the type of proposal and funding level.

- 8 to 10 awards for Exploring Theory and Design Principles for Innovations (ETD) with durations up to three years and budgets up to \$500,000;
  - 8 to 10 awards for Developing and Testing Innovations (DTI) with durations up to four years and budgets up to \$1,300,000;
  - 3 to 5 awards for Scaling, Expanding, and Iterating Innovations (SEI) with durations up to five years and budgets up to \$3,500,000;
  - 2 to 4 awards for Syntheses with durations up to two years and budgets up to \$400,000; and
  - 2 to 3 awards for Conferences with durations of one year and budgets up to \$100,000.
- In addition, ITEST intends to fund one Resource Center with a duration up to five years and total funding up to \$5,000,000 in FY 2023. This award will be made as a grant.

**Anticipated Funding Amount:** \$25,000,000 to \$30,000,000

NSF anticipates having approximately \$25,000,000 to \$30,000,000 available for the FY23 competition and approximately \$25,000,000 to \$30,000,000 each year thereafter.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds.

## Eligibility Information

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**Who May Submit Proposals:**

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide (PAPPG)*, Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

**Who May Serve as PI:**

There are no restrictions or limits.

**Limit on Number of Proposals per Organization:**

There are no restrictions or limits.

**Limit on Number of Proposals per PI or co-PI:**

There are no restrictions or limits.

## Proposal Preparation and Submission Instructions

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**A. Proposal Preparation Instructions**

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required

- **Full Proposals:**

- Full Proposals submitted via Research.gov: *NSF Proposal and Award Policies and Procedures Guide* (PAPPG) guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg).
- 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: [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=grantsgovguide](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)).

## **B. Budgetary Information**

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.

- **Indirect Cost (F&A) Limitations:**

Not Applicable

- **Other Budgetary Limitations:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

## **C. Due Dates**

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

August 12, 2022

August 11, 2023

August 09, 2024

## **Proposal Review Information Criteria**

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### **Merit Review Criteria:**

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

## **Award Administration Information**

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### **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

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The world is experiencing rapid acceleration in the development of new information and communication technologies (ICT). The convergence of both technological and computational advancement has led to the transformative emergence of artificial intelligence, quantum computing, biotechnology, robotics, and transdisciplinary research across the fields of science, technology, engineering, and mathematics (STEM). The economic prosperity and national security of the United States is reliant upon our capacity to remain competitive in these and continuously evolving technological and computational fields. Remaining competitive, however, is contingent upon our nation's capacity to educate students in the skills and expertise needed to conceptualize and develop the next generation of technological and computational innovation.

To strengthen the competitiveness of the STEM and computational U.S. workforce, learning and teaching must be reimagined to better represent the diverse cultural composition and perspective of our nation's people, and be expanded to encompass all pathways for students to receive an equitable, high-quality STEM education that includes learning with technology and applying computing to technical problem-solving. Widespread inequality in education and lack of access to technology is leaving too many students unable to participate in, or contribute to, the nation's critical technical and computational infrastructure. As a result, the nation's workforce is unprepared to solve the most pressing scientific and technical problems of our time—affecting not only our nation's competitiveness, but its national security. In the Biennial Report to Congress (2019-2020) <sup>[1]</sup> the Committee on Equal Opportunities in Science and Engineering (CEOSE) suggests "diverse perspectives are necessary for solving critical scientific and social challenges, such as disease, hunger, poverty, safety and security. Yet, statistics show relatively little diversity in the fields of science, technology, engineering and mathematics necessary to solve those issues." The ITEST program, mandated by Congress by the *American Competitiveness in the Twenty-first Century Act of 2000*, <sup>[2]</sup> is one way in which the National Science Foundation (NSF) is responding to the challenge and opportunity to address inequities in STEM education related to the technological and computational workforce.

The overarching vision of the ITEST program is to support applied research and development that provides pre-kindergarten to high school students with equitable and inclusive access to robust, rigorous, and effective learning opportunities using technology integral to a high-quality education in science, technology, engineering, and mathematics. Three core ITEST Pillars (*Innovative Use of Technologies in Learning and Teaching*, *Partnerships for Career and Workforce Preparation*, and *Strategies for Equity in STEM Education*) frame the opportunities for all students to acquire the foundational preparation in fields aligned with the technological and computational workforce, including students in underserved regions and Tribal Nations where access to technology and virtual learning remains a substantial challenge. Students emerging from their STEM education with proficiency in emerging technological and computational fields will find increasing career opportunities (Office of Occupational Statistics and Employment Projections, 2021).

Proposed ITEST projects are expected to (1) engage students in technology-rich learning to develop disciplinary and/or transdisciplinary STEM content knowledge, including skills in data literacy and evidence-based decision-making and reasoning; (2) prioritize the full inclusion of groups who have been underrepresented and/or underserved, including but not limited to Blacks and African Americans, Alaska Natives, Hispanics and Latinos, Native Americans, Native Hawaiians, Native Pacific Islanders, persons with disabilities, neurodiverse students, and women in the STEM/ICT workforce; (3) motivate students to pursue appropriate education pathways to technology-rich careers; and (4) leverage strategic and community partnerships to expand education pathways in communities through public and private partnerships and collaborations.

[1] National Science Foundation (2020). Committee on Equal Opportunities in Science and Engineering (CEOSE) Biennial Report to Congress: *Making Visible the Invisible--Bold Leadership Actions*. Retrieved from: [CEOSE | 2019-2020 Biennial Report to Congress \(nsf.gov\)](https://www.nsf.gov/pubs/2020/ceo2019-2020_biennial_report_to_congress.pdf)

[2] American Competitiveness in the Twenty-first Century Act of 2000. AICA PL 106-313 PUBLIC LAW 106-313—OCT. 17, 2000. Retrieved from: <https://www.congress.gov/106/plaws/publ313/PLAW-106publ313.pdf> Section 110

## II. PROGRAM DESCRIPTION

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The following three ITEST Pillars are the core intellectual foci of the ITEST program. In aggregate, these Pillars advance the solicitation's career and workforce objectives. **Each Pillar is required to be presented in all proposals.** The perspectives, issues, and elements discussed under each Pillar are for consideration by investigators within the context of the proposed research and development.

### A. ITEST Pillars

#### Pillar 1. *Innovative Use of Technologies in Learning and Teaching*

ITEST requires that proposed activities engage students and/or informal learners in the use of technologies that will support acquisition of the foundational preparation in STEM and information and communication technologies.

When responding to this Pillar, consideration should be given to how specific disciplinary concepts will be taught, such as how the proposed technology will be used to improve or deepen students' conceptual and disciplinary understanding, critical thinking skills, development of competencies in computing, computational thinking, data literacy, and evidence-based decision-making and reasoning. It is not sufficient for students to gain only experience in how to use technology. Students need to learn the creative ideas and STEM knowledge behind technology, such as the highly creative application of artificial intelligence used to solve scientific and social problems for the benefit of society or Quantum information science (QIS) as a new field of science and technology. When addressing more than one STEM discipline, as in transdisciplinary learning, discussion of the research on integrative teaching and learning processes is an important consideration.

The following details are considerations for clear descriptions of this required Pillar:

- Discuss the key design features of the interventional technology, including grounding in relevant scholarly literatures and/or evidence from practice; how the intervention provides innovative STEM learning experience with age and grade appropriateness, and contributes to broadening participation of students underrepresented and/or underserved in STEM; how the learning process itself will be studied to understand how and under what conditions the technology may have an effect on students' STEM learning.
- Discuss how students' engagement with the proposed technology-infused disciplinary or transdisciplinary learning activities will strengthen disciplinary

knowledge, skills, and dispositions in one or more disciplinary areas; explain the measures for cognitive outcomes (such as changes in knowledge) and social or affective outcomes (such as changes in motivation, engagement, interest, dispositions, or attitudes) and how they are appropriate for participants.

- Discuss any professional development of PreK-12 teachers or other relevant educators in the use of technology in the classroom or informal settings for STEM learning; the ways in which the technology will be designed specifically for teaching, and/or integrated within a curriculum, including discussion of specific research methods for understanding how the professional development activity for teachers will ultimately demonstrate an effect on their students' disciplinary understanding and skills in STEM/ICT.

## **Pillar 2. Partnerships for Career and Workforce Preparation**

Core to this Pillar is the call for investigators to work with community stakeholders to identify and define opportunities for proposed research to support students' awareness and preparation for careers in the technological and computational workforce.

Opportunities, such as entrepreneurship, apprenticeships, externships, internships, and mentoring can promote or support students' STEM engagement and interest in STEM/ICT careers. Community stakeholders may include, but are not limited to, neighborhood or community groups, nonprofit or philanthropic organizations, businesses, libraries, museums, educational institutions, and other agencies.

The voices, knowledge, and experiences of individuals who have been underrepresented and/or underserved in STEM should be considered to play a key role at the center of strategic partnerships, collaborations, and career guidance to ensure that students have full and equitable opportunities to prepare for the future workforce. Such community-based strategies include, for example: project leadership, research positions, conceptualization of the partnership, decision-making processes, and interpretation and dissemination of evidence and research results.

The following details are considerations for clear descriptions of this required Pillar:

- Describe how partnerships will strengthen existing collaborations and/or develop new connections between educational institutions, employers, and their communities; how will opportunities, such as entrepreneurship, apprenticeships, externships, internships, and mentoring promote or support students' STEM engagement and interest in STEM/ICT careers. Specify how partnerships directly engage students, parents, and/or teachers in STEM career-based learning experiences, as is age-appropriate and may capitalize on formal and/or informal learning contexts to support academic learning.
- Discuss partnerships led by, or that actively incorporate the values and diverse perspectives of individuals from groups that are underrepresented and/or underserved in the technological and computational fields.
- Successfully sustaining a partnership requires trust to identify and negotiate differences between policies and culture. Discuss the collaborative theory of action, how it is being implemented, and the ways in which the partnership will benefit students, educators, and strategic partners, such as schools, industries, and professional organizations.

## **Pillar 3. Strategies for Equity in STEM Education**

"The goal of broadening participation is not only an issue of fairness and equal opportunity but is the means of bringing diversity and intellectual breadth to the transformation of science itself." (NSF GPRA Report 2009 and in CEOSE 2011-2012).

The ITEST program seeks to advance NSF's vision of STEM inclusivity by leveraging diversity of intellectual and cultural perspectives to meet the goal of a fully inclusive and fully diverse STEM workforce. Ensuring equity and strengthening access and inclusion for the diverse groups of PreK-12 learners who are underrepresented and/or underserved in STEM fields is fundamental to broadening participation in the high-quality careers and high-paying jobs in the technological and computational STEM workforce. Exclusion from participation diminishes the nation's capacity for creative and innovative scientific discovery, including new technologies and advances in computing capacity that the U.S. depends upon for global economic competitiveness.

The following details are considerations for clear descriptions of this required Pillar:

- Discuss specific strategies for including participants from underrepresented and/or underserved groups. In this solicitation underrepresented and underserved groups in STEM fields include, but not limited to, Blacks and African Americans, Alaska Natives, Hispanics and Latinos, Native Americans, Native Hawaiians, Native Pacific Islanders, persons with disabilities, persons from economically disadvantaged backgrounds, women, and individuals or representatives of lesbian, gay, bisexual, transgender and queer (LGBTQ) communities.
- Discuss strategies needed to overcome any challenges and inequities that exist in areas of practice or organizational culture/climate that have affected participants' inclusion in the STEM enterprise.
- Discuss how strategies and approaches might be advancing educators teaching in communities with high populations of underrepresented and underserved students in STEM.
- Discuss explicit strategies for addressing or accommodating the specific characteristics and needs of all targeted underrepresented and/or underserved participants.

## **B. Research Project Types and Requirements**

ITEST proposals must advance the goals of increasing student knowledge of, and interest in, STEM and ICT careers as well as the development of STEM / ICT knowledge and skills required for pursuit of those careers. Proposals should clearly identify the specific age- and grade-appropriate STEM disciplinary concepts and educational practices that will be addressed. There is no expectation that proposals will address all disciplines included in STEM but may engage students or teachers in more than one discipline or as part of an integrated STEM curriculum.

### **B1. Project Types**

ITEST supports three types of applied research and development projects, as well as synthesis studies and conferences/workshops. The amount of funding and duration requested in proposals submitted to the ITEST solicitation should align with the maturity of the proposed work and the size and scope of the empirical effort.

#### **Exploring Theory and Design Principles (ETD)**

ETD projects describe and explore extant conditions and factors in the field intended to increase students' (and educators') STEM knowledge and motivation, participation, persistence, confidence, and resilience in STEM and ICT fields. ETD studies build core knowledge, interrelated theory, design principles and methods. Successful ETD proposals demonstrate strong potential to yield a preliminary theoretical framework, prototype or design principles, methods or features that increase STEM knowledge, and knowledge and interest in STEM and ICT careers among PreK- 12 students in formal and informal settings, particularly students from underserved and/or underrepresented populations. This project type is appropriate for projects in the conceptualization and planning phase with the goal of developing proof of concept.

***Up to three years, up to \$500,000***

**Developing and Testing Innovations (DTI)**

DTI projects draw on existing theory and evidence to design and iteratively develop interventions, including testing individual intervention components, to provide feedback in the development process. DTI proposals involve designing a theoretically driven innovation, pilot-testing or implementing the innovation and analyzing its outcomes. DTI studies focus on direct engagement with students and educators and assessment of student outcomes relevant to ITEST's primary goals of increasing student knowledge of, and interest in STEM and ICT careers as well as the development of STEM / ICT knowledge and skills required for pursuit of those careers. Results from DTI studies should inform the project's guiding theory of change and may lead to additional work to better understand the guiding theory. DTI projects may also indicate that the intervention is sufficiently promising to warrant large-scale testing, and expansion or iteration of innovations. DTI projects must be clear on the guiding theory of change, logic model, or other rationale for the relationship between its proposed activities and anticipated outcomes.

DTI implementation involves all students in underserved and or underrepresented student populations in PreK-12 formal or informal settings. Research on implementation should explicitly attend to the ways in which the design principles or features of the innovation capitalize on the strengths and challenges that participating student populations bring to the learning environments and how the design principles or project features are expected to influence student knowledge of and interest in STEM and ICT careers.

***Up to four years, up to \$1,300,000***

**Scaling, Expanding, and Iterating Innovations (SEI)**

SEI studies are designed to build on and expand an existing innovation that has evidence of success (including DTI projects or similar innovations previously developed within or outside of the ITEST portfolio). SEI projects (a) broaden the implementation and research of an innovation at a significant scale of five to ten times greater than the original implementation. (b) extend an innovation to different student populations, regions of the country, grade levels or ages of students with varying skills, and educators' capacities in PreK-12 formal and informal settings; (c) examine issues of transferability and generalizability and the factors that support or inhibit scaling; and (d) assess cognitive and social-emotional student outcomes and measure student STEM knowledge and whether students continue to pursue further STEM and ICT education or careers.

***Up to five years, up to \$3,500,000***

**Synthesis Studies**

Synthesis proposals should focus on a question, issue, or topic of critical importance to the ITEST program's pillars. ITEST supports various types of syntheses including literature reviews, qualitative meta-syntheses, and meta-analyses focused on effective technology-based models, efforts to advance students' interest in or awareness of STEM and ICT careers in PreK-12 STEM learning environments, and measurement of cognitive and social-emotional student outcomes in relation to STEM learning and learning environments. Synthesis studies are expected to generate products usable by researchers and practitioners and indicate how the products serve the ITEST program goals. The goals, potential outcomes and dissemination plan for the proposed work should be emphasized. Synthesis proposals must demonstrate a command of the literature or topic to be addressed in both breadth and depth. They should also strive to present the current state of knowledge in the area of interest and highlight issues for future research. Synthesis proposals should explain and justify the methodological approach (e.g., meta-analysis or meta-synthesis), and should outline the systematic steps that will be taken regarding literature identification and decision points (e.g., identifying inclusion and exclusion criteria and outcome measures of interest).

Investigators interested in Synthesis proposals are strongly encouraged to contact a program officer prior to submission to discuss proposal idea(s).

***Up to two years, up to \$400,000***

**Conference or Workshop Projects**

ITEST supports conference or workshop projects aimed at advancing the ITEST program goals, objectives and pillars as described in this solicitation. All proposals in this category should address the need for the work, why it is timely, and the expected contributions to understanding or advancing the question, issue, or topic. Proposals must demonstrate command of the literature and the challenges and opportunities related to current practice of the topic selected. They must also describe the expertise and selection criteria of participants, include a conceptual framework, a draft agenda, the expected outcomes or products resulting from the conference or workshop activities. Finally, all conference/workshop proposals should discuss how these outcomes will be useful and disseminated to the research and practitioner communities and the broader public. Conference or workshop proposals may be submitted anytime during the year and reviewed accordingly. Proposers should contact a program officer prior to submission to discuss their ideas. For general guidance, follow the PAPPG guidance for preparing Conference Proposals (PAPPG II.E.9). The "Conference" type of proposal should be selected in Research.gov or Grants.gov.

***Up to one year, up to \$100,000***

**B2. High-Quality Research Plans, excluding Synthesis and Conference/Workshops**

ITEST research and development proposals (i.e., ETD, DTI and SEI projects) must include objectives of frontier educational and societal importance, sound literature reviews, clearly formulated research questions and research designs, and valid and reliable measurement instruments (or plans to develop such instruments). Appropriate data collection and analysis methods that contribute to high-quality evidence-based projects are also required. **ITEST proposals must outline a research plan explaining how the project will fulfill its short- and long-term aims.** Moreover, projects should focus on ensuring that these elements of the proposal align into a coherent framework.

Students / PreK-12 learners are required participants. Projects **proposing teacher professional development are required to address how** student outcomes **will be** examined in relation to educator learning outcomes or learning processes. Research measures should attend to cognitive processes and outcomes (such as changes in knowledge required for STEM and ICT domains and careers), and social-emotional facets of learning (such as changes in motivation, engagement, interest, dispositions, or attitudes towards STEM and ICT careers) for individual and groups of students.

Consistent with the NSF Merit Review Criteria of Intellectual Merit and Broader Impacts, research plans should aim to advance scholarly literatures and promote understanding of the context-specific factors that influence the impacts of designed innovations. Research can be framed as design-based with both practical and theoretical implications. ITEST proposals can include a variety of research designs and methodologies but must include the following four components: (1) a high-quality research plan, including selection of a project type that is aligned to the proposal's aims, (2) a description of how the proposal addresses ITEST's solicitation-specific criteria, (3) a project evaluation plan, and (4) a dissemination plan.

The following details are required of all research plans:

- Research questions that are appropriately framed and motivated by scholarly literatures relevant to STEM learning, teaching, student interest in and awareness of STEM / ICT careers, broadening participation, innovative uses of technology, and/or strategic partnerships.
- Research questions that are theory-oriented and enhance the ability to explain the relation between the proposal's design and the anticipated outcomes.
- Specific plans for collecting quantitative and/or qualitative data that can inform the research questions. Such data may include but are not limited to cognitive and social-emotional outcomes, mediating factors (e.g., patterns of engagement, discussion, and affect), characteristics of participants, features of the innovative technologies, and participants' interactions with them.
- Well-defined analytical methods appropriate for drawing inferences from the collected data to address the research questions.
- A description of the research team's roles and expertise including their qualifications for working with the target student population and other research participants.

### **B3. Solicitation Specific Review Criteria**

Consistent with Pillar 3 (**Strategies for Equity in STEM Education**), all ITEST proposals are **required** to address the Solicitation Specific Review Criteria identified below. Proposers must address these four questions within the project description with appropriate headings:

1. To what extent does the proposal include explicit and adequate strategies for recruiting and selecting participants from underserved and underrepresented populations in STEM professions, careers, or education pathways?
2. To what extent does the proposal describe approaches to address diversity, access, equity, and inclusion in PreK-12 learning environments to ensure that all students, particularly those from underserved and underrepresented populations, actively engage with STEM disciplines and fields that stimulate effective instruction and learning?
3. To what extent does the proposal describe specific research-informed instructional approaches to build on the strengths and challenges that students and their educators bring to classrooms and informal learning environments, particularly with students from underserved and underrepresented populations in STEM fields?
4. To what extent does the proposal explain how planned innovations with the technology are developmentally and age-appropriate for students and suited for the specific populations of students and educators from underserved and underrepresented student populations?

In addressing the solicitation-specific review criteria, ITEST especially welcomes proposals that will pair well with the efforts of NSF Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (NSF INCLUDES) to develop STEM talent from all sectors and groups in our society. Collaborations are encouraged between ITEST proposals and existing NSF INCLUDES projects, provided the collaboration strengthens both projects.

### **B4. Project Evaluation**

ITEST proposals must include a project evaluation plan that details the mechanisms that will be used to assess the project's success in developing students' STEM knowledge and their knowledge of and interest in STEM and ICT careers. The evaluation plan should describe the steps that will effectively provide feedback on all aspects of the work both formatively and summatively. Evaluation plans can involve an external Advisory Board and/or a formal external evaluation, depending on the project's aims and scope of work.

Formative evaluation is often designed to document the extent to which project activities are being carried out as intended and to provide information on interim outcomes. Such information allows the project team not only to assess success over the course of the project, but also to make mid-course corrections iteratively to improve the project. Summative evaluation activities typically focus on documenting the final outcomes achieved and the extent to which these are in line with the original goals of the project. Evidence from ongoing evaluative activities may provide valuable insights into any discrepancies between stated and achieved outcomes.

The following details are essential for clear descriptions of a project evaluation plan:

- Identification of the mechanisms for providing independent oversight and review of these activities (e.g., an independent, third-party evaluator or an external advisory board).
- Articulation of evaluation questions relevant to the project's scope of work.
- Delineation of the activities and data that will be used to gather evidence that informs the evaluation questions and identification of the project staff who will be responsible for gathering this evidence.
- Description of how the project plans to use the evaluation evidence, including how feedback will be shared, with whom (e.g., project leadership, external advisors), and for what purpose (e.g., to inform ongoing project management, to supplement research findings and contribute to the generation of knowledge).
- Inclusion of project evaluation activities in the project timeline.

### **B5. Dissemination of Findings**

ITEST proposals are required to include a communication strategy for reaching broad audiences, including scholars, practitioners, policymakers, and the public. While the potential results of the proposed research are expected to be of sufficient quality and significance to merit peer-reviewed publications, approaches that reach broader audiences are also expected.

The following details are essential for clear descriptions of this component:

- Key elements of the communication plan, such as target audiences and the channels, media, or technologies appropriate for reaching specific audiences.
- Dissemination strategies that reach audiences that are appropriate to the strategic partnership, in addition to scholars reached through publications and presentations in conferences and other similar environments.

### **C. ITEST Resource Center**

ITEST intends to fund one Resource Center in FY 2023 to build a community of educational researchers and practitioners consistent with the purpose of ITEST. An important aim of the resource center will be to foster a community of research and practice that is framed around the NSF's current and emerging priorities. The Center is expected to provide technical support for all ITEST active and prospective PIs and partners, facilitate dissemination of awards' outcomes, convene PI meetings, advance the mission of broadening participation in STEM and ICT careers and career education pathways, and respond to the needs of the ITEST program. The size of the request should be appropriate to the scope of work proposed. The "Center" type of proposal should be selected in Research.gov or Grants.gov.

The Resource Center is expected to advance the goals of ITEST through (a) capacity building and technical support that facilitates ITEST projects' success and articulates innovative models for STEM learning environments; (b) synthesizing and disseminating ITEST projects' findings nationally to inform the national STEM education fields; and (c) conducting outreach to broaden participation from the ITEST and NSF communities, as well as from states, organizations, and higher education institutions not currently represented in the ITEST portfolio. Expectations for the Resource Center are outlined below.

#### Up to five years, up to \$5,000,000

**C1. Capacity Building:** The ITEST Resource Center is expected to build the capacity of the ITEST community to develop and execute innovative research and development projects consistent with ITEST's goals. This work includes facilitating discussions across a network of active and potential ITEST projects through appropriate means to facilitate the development of a broader and better-connected research and development community.

**C2. Technical Support:** The ITEST Resource Center is expected to provide technical support to facilitate ITEST projects' success in developing and articulating innovations that strengthen student knowledge of, and interest in, STEM and ICT careers as well as the development of STEM / ICT knowledge and skills required for pursuit of those careers. Support activities can include but are not limited to, providing short-term online or blended professional development courses and workshops for educators, facilitating the emergence and development of communities of practice, identifying promising practices and resources (both print and digital) that may help projects in achieving their goals, and assisting prospective PIs with access to information about ITEST outcomes and resources.

**C3. Synthesis and Dissemination:** The ITEST Resource Center is expected to synthesize and disseminate ITEST projects' findings nationally to inform and influence the community of stakeholders. This work includes conducting a comprehensive analysis of the ITEST portfolio for internal and external stakeholders annually and as needed. It also includes implementing a comprehensive dissemination plan to communicate ITEST outcomes and resources to formal and informal STEM education professional organizations, industry and policy stakeholders, and STEM education research communities about the significant unique contributions of ITEST projects to the field.

**C4. Broadening Participation in the ITEST PI Community:** The ITEST Resource Center is expected to conduct outreach efforts to broaden participation in the ITEST community. Specifically, the Resource Center should seek individuals from organizations and communities underrepresented or not currently represented in the ITEST portfolio and facilitate increased participation in STEM workforce development through expansion of the ITEST portfolio to underrepresented geographic regions, community types (e.g., rural, suburban, or urban), and institutions (e.g., minority-serving institutions, community colleges, school districts, or formal and informal learning centers).

**C5. Responding to the Needs of the ITEST Program:** The Center is expected to collaborate with other EHR-supported resource centers. Collaboration among resource centers is necessary to broaden awareness of the various funding programs and resources in STEM education and promote synergistic efforts to advance the knowledge base and broader participation in STEM education. The Center is also expected to host annual ITEST Awardee Meetings.

The lead institution of the ITEST Resource Center is expected to demonstrate the capacity to plan, develop, and manage a national center that provides technical support to a diverse portfolio of projects. The lead institution should have proven expertise in STEM and ICT, formal and informal STEM education, and capacity building of STEM educators and researchers. The lead institution and any identified partners should also show expertise in relation to the ITEST program pillars.

NSF intends to ensure systematic communication and participation between NSF and the potential ITEST Resource Center awardee, including annual assessment of progress and implementation of necessary modifications.

#### D. Relevant References

Broadening Participation in America's STEM Workforce. Retrieved from: <https://www.nsf.gov/od/oia/activities/ceose/reports/2011-2012-ceose-biennial-report-508.pdf>.

National Academies of Sciences, Engineering, and Medicine. (2017). *Building America's skilled technical workforce*. Washington, DC: The National Academies Press. Retrieved from: <https://www.nap.edu/read/23472/chapter/1>.

National Academies of Sciences, Engineering, and Medicine. (2018). *Measuring the 21st century science and engineering workforce population: Evolving needs*. Washington, DC: The National Academies Press. Retrieved from: <https://nap.nationalacademies.org/read/24968/chapter/1>.

National Q-12 Education Partnership. (2021). *QIS Key Concepts for Early Learners: K-12 Framework*. Retrieved from: <https://q12education.org/learning-materials/framework>

National Science Board. (2018). *Our nation's future competitiveness relies on building a STEM-capable U.S. workforce: A policy companion statement to Science and Engineering Indicators 2018*. Arlington, VA: National Science Foundation. Retrieved from: <https://www.nsf.gov/nsb/sei/companion-brief/NSB-2018-7.pdf>.

National Science Board. (2020). *NSB Statement on Racism in Science and Engineering*. Retrieved from: [https://www.nsf.gov/nsb/news/news\\_summ.jsp?cntn\\_id=300730](https://www.nsf.gov/nsb/news/news_summ.jsp?cntn_id=300730)

National Science Board. (2020). *Vision 2030*. (NSB-2020-15). Retrieved from: <https://www.nsf.gov/nsb/publications/vision2030.pdf>.

National Science Foundation (2013). Committee on Equal Opportunities in Science and Engineering (CEOSE) *2011-2012 Biennial Report to Congress: Broadening Participation in America's STEM Workforce*.

National Science Foundation (2020). Committee on Equal Opportunities in Science and Engineering (CEOSE) Biennial Report to Congress: *Making Visible the Invisible--Bold Leadership Actions*. Retrieved from: [CEOSE | 2019-2020 Biennial Report to Congress \(nsf.gov\)](https://www.nsf.gov/ceose/2019-2020-biennial-report-to-congress)

National Science Foundation. (2018). *Building the future: Investing in discovery and innovation - NSF strategic plan for fiscal years (FY) 2018 - 2022 (NSF 18-045)*. Retrieved from: [https://www.nsf.gov/about/performance/strategic\\_plan.jsp](https://www.nsf.gov/about/performance/strategic_plan.jsp)

National Science Foundation. (n.d.). *Broadening participation*. Retrieved from: <https://www.nsf.gov/od/broadeningparticipation/bp.jsp>

National Science & Technology Council: Committee on STEM Education. (2018). *Charting a course for success: America's strategy for STEM education*. Retrieved from: <https://www.energy.gov/sites/default/files/2019/05/f62/STEM-Education-Strategic-Plan-2018.pdf>.



### III. AWARD INFORMATION

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**Anticipated Type of Award:** Standard Grant or Continuing Grant

**Estimated Number of Awards:** 24 to 33

ITEST expects to fund between 24 and 33 awards per year depending on the type of proposal and funding level.

- 8 to 10 awards for Exploring Theory and Design Principles for Innovations (ETD) with durations up to three years and budgets up to \$500,000;
  - 8 to 10 awards for Developing and Testing Innovations (DTI) with durations up to four years and budgets up to \$1,300,000;
  - 3 to 5 awards for Scaling, Expanding, and Iterating Innovations (SEI) with durations up to five years and budgets up to \$3,500,000;
  - 2 to 4 awards for Syntheses with durations up to two years and budgets up to \$400,000; and
  - 2 to 3 awards for Conferences with durations of one year and budgets up to \$100,000.
- In addition, ITEST intends to fund one Resource Center with a duration up to five years and total funding up to \$5,000,000 in FY 2023. This award will be made as a grant.

**Anticipated Funding Amount:** \$25,000,000 to \$30,000,000

NSF anticipates having approximately \$25,000,000 to \$30,000,000 available for the FY23 competition and approximately \$25,000,000 to \$30,000,000 each year thereafter.

Estimated program budget, number of awards and average award size/duration are subject to the availability of funds

### IV. ELIGIBILITY INFORMATION

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#### Who May Submit Proposals:

The categories of proposers eligible to submit proposals to the National Science Foundation are identified in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG), Chapter I.E. Unaffiliated individuals are not eligible to submit proposals in response to this solicitation.

#### Who May Serve as PI:

There are no restrictions or limits.

#### Limit on Number of Proposals per Organization:

There are no restrictions or limits.

#### Limit on Number of Proposals per PI or co-PI:

There are no restrictions or limits.

### V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

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#### A. Proposal Preparation Instructions

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**Full Proposal Preparation Instructions:** Proposers may opt to submit proposals in response to this Program Solicitation via Research.gov or Grants.gov.

- Full Proposals submitted via Research.gov: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the *NSF Proposal and Award Policies and Procedures Guide* (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=papppg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papppg). Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from [nsfpubs@nsf.gov](mailto:nsfpubs@nsf.gov). The Prepare New Proposal setup will prompt you for the program solicitation number.
- 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: ([https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=grantsgovguide](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide)). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from [nsfpubs@nsf.gov](mailto:nsfpubs@nsf.gov).

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

Collaborative Proposals. All collaborative proposals submitted as separate submissions from multiple organizations must be submitted via Research.gov. PAPPG Chapter II.D.3 provides additional information on collaborative proposals.

See PAPPG Chapter II.C.2 for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

The following information supplements the standard PAPPG or NSF Grants.gov Application Guide proposal preparation guidelines:

**Type of Proposal:**

- Select the "Research" type of proposal for ETD, DTI, SEI or Synthesis proposals.
- Select the "Conference" type of proposal for Conference proposals.
- Select the "Center" type of proposal for Resource Center proposals.

**Proposal Title:** Please begin the title with the type of research project being submitted (i.e., Exploring Theory and Design Principles [ETD]; Developing and Testing Innovations [DTI]; Scaling, Expanding, and Iterating Innovations [SEI]; Synthesis; Conference or Center, followed by a colon, and the title of the proposal. Please note that if submitting via Research.gov, the system will automatically insert the prepended title "Conference" when the Conference proposal is created and "Center" when a Center proposal is created.

**Cover Sheet:** Prospective PIs should complete this sheet with all the requested information.

If the proposer requests that another NSF program also consider the proposal, that must be indicated on the Cover Sheet. Instructions for Research.gov (effective May 2, 2022): Additional programs can be added once the proposal is created by clicking on "Manage Where to Apply" under "Where to Apply" on the main proposal page.

Please make sure to check the human subjects box if the proposal involves human subjects. To avoid delays in processing award recommendations, it is strongly recommended that PIs begin the process of obtaining appropriate Institutional Review Board (IRB) approvals or exemptions as needed for projects involving human subjects. No awards will be made without such approvals or exemptions.

**Project Summary:** A one-page Project Summary must be provided, which consists of three parts: (1) an overview, (2) a statement on the intellectual merit of the proposed activity, and (3) a statement on the broader impacts of the proposed activity. The first sentence of the overview must indicate the type of ITEST project being submitted. The overview must describe the STEM content emphases; the approach to be designed, implemented, and evaluated; and the participants to be targeted, including the age ranges or grade levels of student participants.

**Project Description:** This section is limited to a maximum of 15 pages. A proposal must respond fully to the ITEST Program Description in Section II of this program solicitation. Please note that, per guidance in the PAPPG, the Project Description must contain a separate section labeled "Broader Impacts." The Project Description must address the following elements in any order:

**Project Overview, Rationale, and Importance:** The proposal must show how the project addresses critical STEM educational needs and the potential for intellectual merit and broader impacts within the context of the ITEST purpose. The proposal provides an overview of the project goals or objectives, and a rationale for how the work will improve knowledge of and interest in STEM/ICT career pathways for students and advance educators' understanding of STEM/ICT content and career pathways. The proposed work addresses how the planned STEM education innovations differ from existing practice, and why the study has the potential to improve student and educator learning and other educational outcomes beyond what current practices provide.

**Results from Prior NSF Support:** In cases where the prospective PI or any Co-PI has received more than one award (excluding amendments to existing awards), please report only the one award that is most closely related to the proposal.

**Expertise and Management:** The project team should reflect the types of expertise needed to successfully implement and manage the project. An advisory group or consultants who can provide guidance in research design and methodologies, including quantitative or qualitative research methods, implementation, or development of measurement instruments are highly recommended.

**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 design of the project.

**Special Information/Supplementary Documentation:** The only items permitted in the Supplementary information section are (1) letters of collaboration, (2) the data management plan, and (3) the postdoctoral researcher mentoring plan (if applicable).

If submitting via Research.gov, the Data Management Plan should be included in the Data Management Plan section and the Postdoctoral Researcher Mentoring Plan should be included in the Postdoctoral Mentoring Plan section. Both documents should be included as Other Supplementary Documents in Grants.gov.

**Data Management Plan:** Proposers should provide a detailed data management plan. Transparency requires that the Federal agencies share how they are maximizing outcomes of Federal STEM investments and activities and ensuring broad benefit to the public. Proposers are highly encouraged to review the EHR Directorate-specific data management plan guidance, which can be accessed at <https://www.nsf.gov/bfa/dias/policy/dmpdocs/ehnr.pdf>.

**Appendices:** Not permitted. The 15-page project description must contain all the information needed to describe the project. Proposals submitted with an appendix will be returned without review.

## B. Budgetary Information

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**Cost Sharing:**

Inclusion of voluntary committed cost sharing is prohibited.

**Other Budgetary Limitations:**

Major research equipment purchases are not supported. The ITEST program limits the purchase of equipment to software, probes, and specialized equipment needed to implement a specific project. General purpose equipment, such as computers, notepads, and cellphones are not supported.

## C. Due Dates

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

August 12, 2022

August 11, 2023

August 09, 2024

## D. Research.gov/Grants.gov Requirements

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### For Proposals Submitted Via Research.gov:

To prepare and submit a proposal via Research.gov, see detailed technical instructions available at: [https://www.research.gov/research-portal/appmanager/base/desktop?\\_nfpb=true&\\_pageLabel=research\\_node\\_display&\\_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html](https://www.research.gov/research-portal/appmanager/base/desktop?_nfpb=true&_pageLabel=research_node_display&_nodePath=/researchGov/Service/Desktop/ProposalPreparationandSubmission.html). For Research.gov user support, call the Research.gov Help Desk at 1-800-673-6188 or e-mail [rgov@nsf.gov](mailto:rgov@nsf.gov). The Research.gov Help Desk answers general technical questions related to the use of the Research.gov system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

### For Proposals Submitted Via Grants.gov:

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

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

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

## VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

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

A comprehensive description of the Foundation's merit review process is available on the NSF website at: [https://www.nsf.gov/bfa/dias/policy/merit\\_review/](https://www.nsf.gov/bfa/dias/policy/merit_review/).

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Building the Future: Investing in Discovery and Innovation - NSF Strategic Plan for Fiscal Years (FY) 2018 – 2022*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

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

### A. Merit Review Principles and Criteria

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

every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

## 1. Merit Review Principles

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

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

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

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

## 2. Merit Review Criteria

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

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

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

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

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

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and other underrepresented groups in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

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

## Additional Solicitation Specific Review Criteria

All ITEST proposals are **required** to address the Solicitation Specific Review Criteria identified below. Proposers must address the following four questions within the project description with appropriate headings. Reviewers will be asked to evaluate proposals based on how broadening participation is described in the proposal, including the solicitation-specific review criteria. Proposers and reviewers must answer the following questions:

1. To what extent does the proposal include explicit and adequate strategies for recruiting and selecting participants from underserved and underrepresented populations in STEM professions, careers, or education pathways?
2. To what extent does the proposal describe approaches to address diversity, access, equity, and inclusion in PreK-12 learning environments to ensure that all students, particularly those from underserved and underrepresented populations, actively engage with STEM disciplines and fields that stimulate effective instruction and learning?
3. To what extent does the proposal describe specific research-informed instructional approaches to build on the strengths and challenges that students and their educators bring to classrooms and informal learning environments, particularly with students from underserved and underrepresented populations in STEM fields?
4. To what extent does the proposal explain how planned innovations with the technology are developmentally and age-appropriate for students and

suiting for the specific populations of students and educators from underserved and underrepresented student populations?

In addressing the solicitation-specific review criteria, ITEST especially welcomes proposals that will pair well with the efforts of NSF Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES) to develop STEM talent from all sectors and groups in our society. Collaborations are encouraged between ITEST proposals and existing NSF INCLUDES projects, provided the collaboration strengthens both projects.

## B. Review and Selection Process

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

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

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

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

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

## VII. AWARD ADMINISTRATION INFORMATION

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### A. Notification of the Award

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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

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

\*These documents may be accessed electronically on NSF's Website at [https://www.nsf.gov/awards/managing/award\\_conditions.jsp?org=NSF](https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF). Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-8134 or by e-mail from [nsfpubs@nsf.gov](mailto: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 *Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg).

### C. Reporting Requirements

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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 no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

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

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

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at [https://www.nsf.gov/publications/pub\\_summ.jsp?ods\\_key=pappg](https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg).

For projects with external evaluators, PIs are encouraged to include reports of evaluation activities as part of their annual and final project reports.

## VIII. AGENCY CONTACTS

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

General inquiries regarding this program should be made to:

- Questions related to the Program, telephone: (703) 292-8620, email: [DRLITEST@nsf.gov](mailto:DRLITEST@nsf.gov)

For questions related to the use of FastLane or Research.gov, contact:

- FastLane and Research.gov Help Desk: 1-800-673-6188
- FastLane Help Desk e-mail: [fastlane@nsf.gov](mailto:fastlane@nsf.gov)
- Research.gov Help Desk e-mail: [rgov@nsf.gov](mailto:rgov@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](mailto:support@grants.gov).

## IX. OTHER INFORMATION

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

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

## ABOUT THE NATIONAL SCIENCE FOUNDATION

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

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

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

*Facilitation Awards for Scientists and Engineers with Disabilities (FASSED)* provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See the *NSF Proposal & Award Policies & Procedures Guide* Chapter II.E.6 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 <https://www.nsf.gov>

- **Location:** 2415 Eisenhower Avenue, Alexandria, VA 22314
- **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](mailto:nsfpubs@nsf.gov)
  - or telephone: (703) 292-8143
- **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 [System of Record Notices](#), NSF-50, "Principal Investigator/Proposal File and Associated Records," and NSF-51, "Reviewer/Proposal File and Associated Records." 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  
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Policy Office, Division of Institution and Award Support  
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