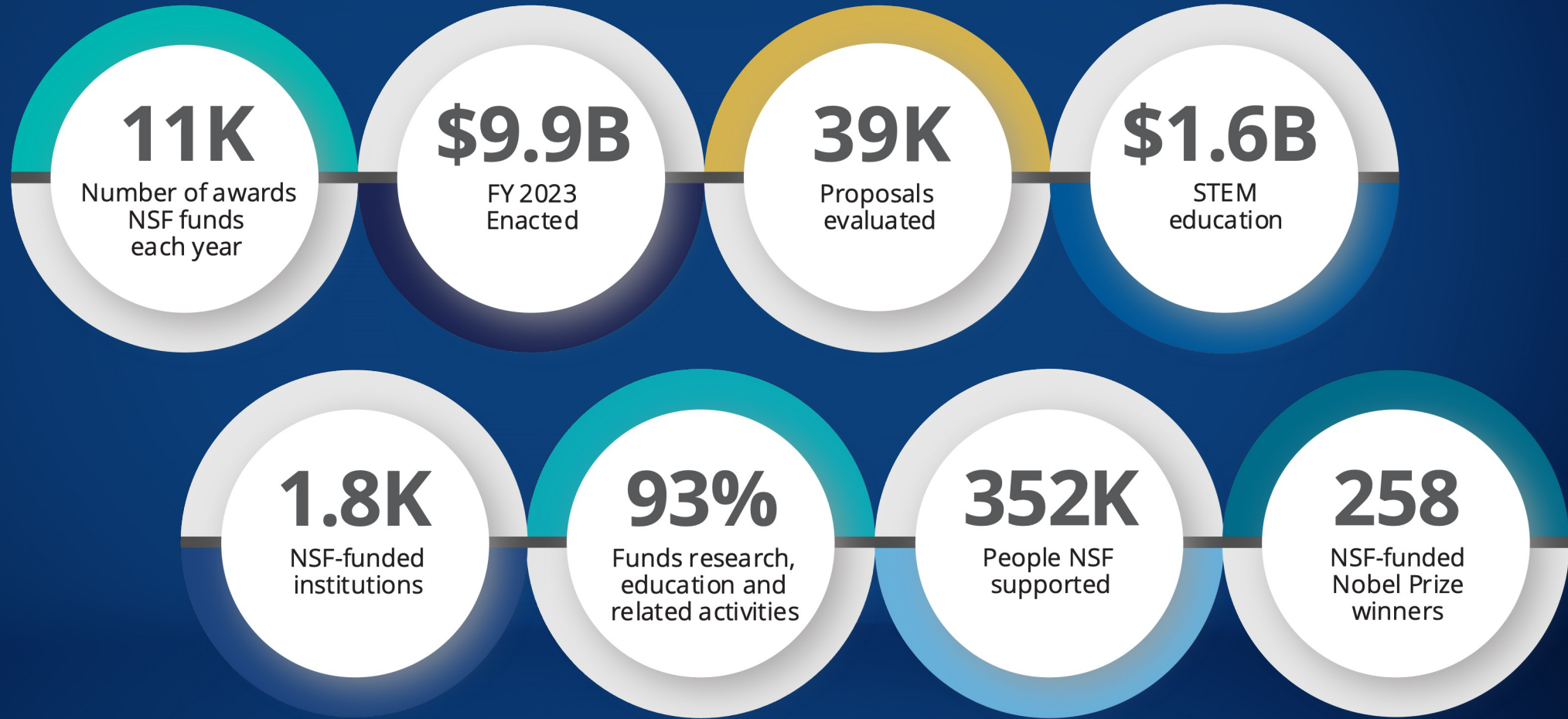# NSF Mission

"*to promote the progress of science; to advance the national health, prosperity, and welfare; [and] to secure the national defense*"

National Science Foundation
Directorate for STEM Education (EDU)

Preparing a diverse STEM workforce and a well-informed citizenry

NSF By the Numbers

11K
Number of awards NSF funds each year

$9.9B
FY 2023 Enacted

39K
Proposals evaluated

$1.6B
STEM education

1.8K
NSF-funded institutions

93%
Funds research, education and related activities

352K
People NSF supported

258
NSF-funded Nobel Prize winners

https://new.nsf.gov/about/about-nsf-by-the-numbers

NSF's 3 Major Priorities

STRENGTHENING ESTABLISHED NSF

With **investments that expand the frontiers of knowledge and technology**.

INSPIRING THE MISSING MILLIONS

Using **interventions and capacity building** that enhance and broaden participation.

ACCELERATING TECHNOLOGY AND INNOVATION

Through innovative, **cross-cutting partnerships** and programs.

Creating Opportunity Everywhere

Research

Investing in research to **increase the knowledge base** surrounding broadening participation.

Education

Using Interventions and capacity building to enhance access and opportunity to STEM education.

Research Infrastructure

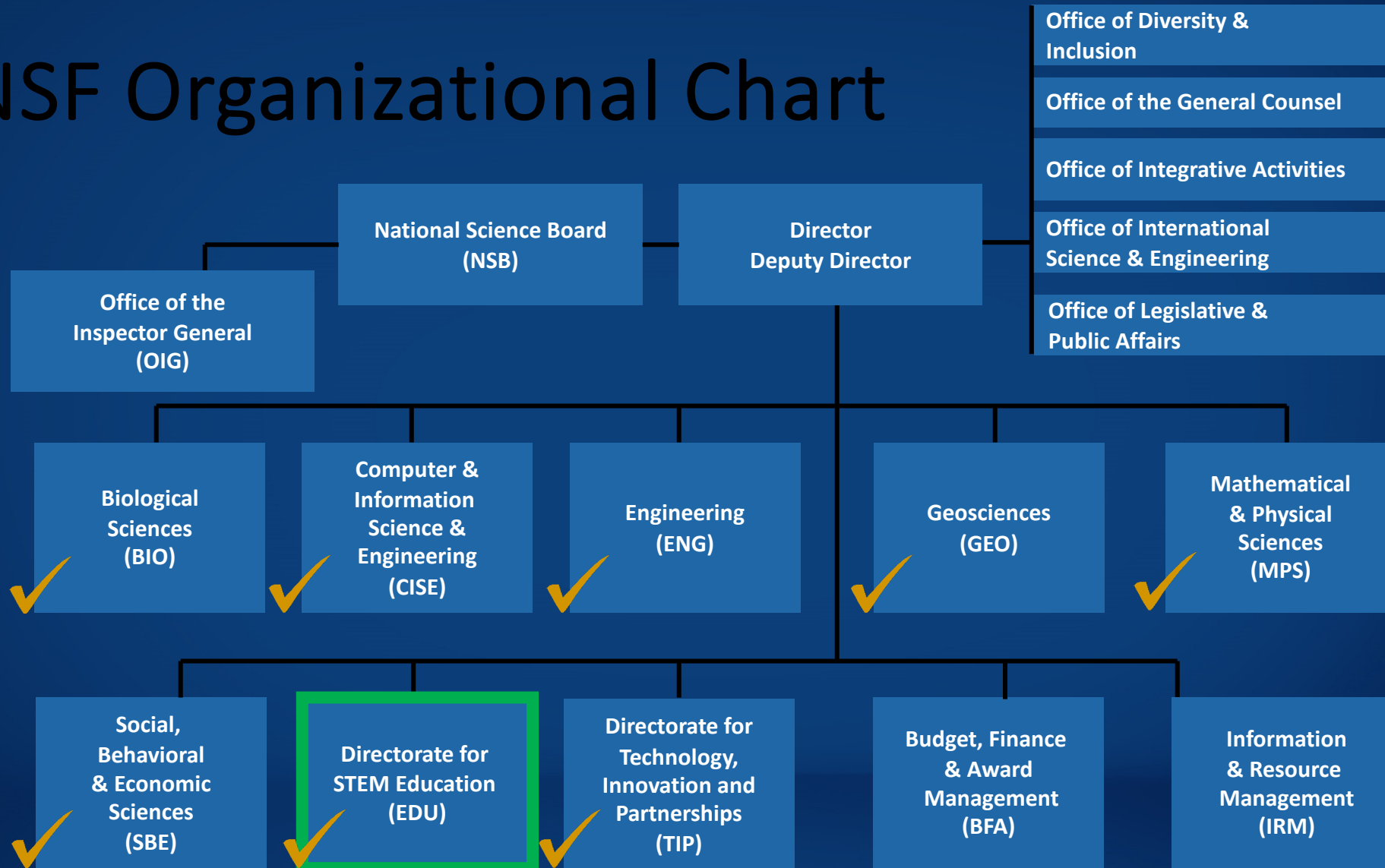Developing the tools and infrastructure needed to **broaden the research community**.

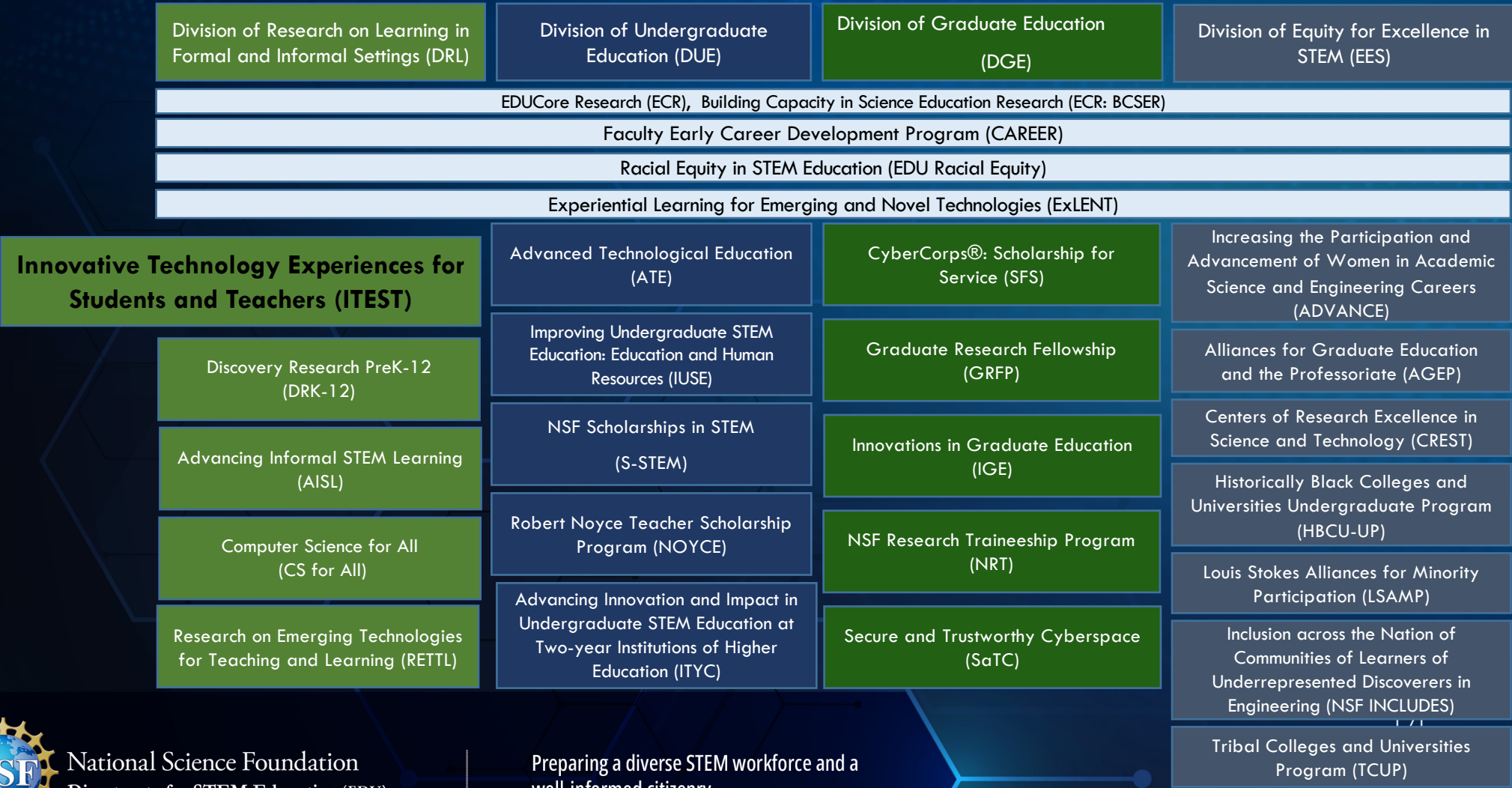## Outreach/Inreach/ Partnerships

Working with **external stakeholders**, the **research community**, and **NSF staff**.

NSF Organizational Chart

EDU: Program Overview

Office of the Assistant Director – Directorate for STEM Education EDU)

Division of Research on Learning in Formal and Informal Settings (DRL)	Division of Undergraduate Education (DUE)	Division of Graduate Education (DGE)	Division of Equity for Excellence in STEM (EES)

EDUCore Research (ECR), Building Capacity in Science Education Research (ECR: BCSER)

Faculty Early Career Development Program (CAREER)

Racial Equity in STEM Education (EDU Racial Equity)

Experiential Learning for Emerging and Novel Technologies (ExLENT)

Innovative Technology Experiences for Students and Teachers (ITEST)	Advanced Technological Education (ATE)	CyberCorps®: Scholarship for Service (SFS)	Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers (ADVANCE)
Discovery Research PreK-12 (DRK-12)	Improving Undergraduate STEM Education: Education and Human Resources (IUSE)	Graduate Research Fellowship (GRFP)	Alliances for Graduate Education and the Professoriate (AGEP)
Advancing Informal STEM Learning (AISL)	NSF Scholarships in STEM (S-STEM)	Innovations in Graduate Education (IGE)	Centers of Research Excellence in Science and Technology (CREST)
Computer Science for All (CS for All)	Robert Noyce Teacher Scholarship Program (NOYCE)	NSF Research Traineeship Program (NRT)	Historically Black Colleges and Universities Undergraduate Program (HBCU-UP)
Research on Emerging Technologies for Teaching and Learning (RETTL)	Advancing Innovation and Impact in Undergraduate STEM Education at Two-year Institutions of Higher Education (ITYC)	Secure and Trustworthy Cyberspace (SaTC)	Louis Stokes Alliances for Minority Participation (LSAMP)
			Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering (NSF INCLUDES)
			Tribal Colleges and Universities Program (TCUP)

National Science Foundation
Directorate for STEM Education (EDU)

Preparing a diverse STEM workforce and a well-informed citizenry

Agenda

1. Overview of ITEST (Wu He)

2. Required ITEST Pillars & Solicitation-Specific Review Criteria (Jennifer Noll)

3. Research & Evaluation (Jennifer Noll)

4. Project Categories, Emerging Workforce Priorities and Activating EPSCoR (Joan Walker)

Some Examples of ITEST Funded Projects

Show & Tell ITEST Awards

Award#: 2048884: Partnership to Provide Technology and Cyber-security Experiences to Alabama Black Belt through Mobile Application Development

Guided by the Project Based Learning (PBL) approach, the project provides, in a group setting, hands-on training in information technology and cybersecurity concepts through a one-month training program (4-week Summer Academy) to 40 high school students annually hosted at Tuskegee University, followed by one semester training in high school on a project of their choice.

Each of the groups is assisted by a computer science faculty of Tuskegee University.

The participating high school students develop a secured mobile application using the MIT APP Inventor environment and test it using an android phone.

https://www.youtube.com/watch?v=YeLQlY_Ugaw

Award#: 1949472: Beyond CS Principles: Engaging Female High School Students in New Frontiers of Computing https://vimeo.com/701379767

Award # 1850447
Understanding Weather Extremes with Big Data: Inspiring Rural Youth in Data Science

The WeatherX

- Collaboration between middle school science teachers in New Hampshire and Maine, educational researchers, and weather scientists.

- Develop and research four model curriculum units and an interactive experience to promote important scientific data practices and interest in big data science careers among middle-school students in underserved New England rural areas.

- Hands-on data investigation opportunities for students to analyze and model large-scale weather data collected from the summit and lower elevations of Mt. Washington, NH (the highest mountain in the eastern United States), as well as data collected from students' local weather stations.

- Learn to describe, explain, model, and predict extreme weather events both in their local settings as well as at Mount Washington Observatory, a site that has recorded some of the most extreme weather conditions in the world.

- Interact through a virtual Chat with a scientist to deepen their understandings of their own data investigations and to gain insights into scientific careers that use big data.

https://vimeo.com/701109649

Introducing ITEST

- 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.**

Overview

- ITEST is **responsive to societal needs** and **emerging areas of STEM** and related careers.

- Emerging areas may include, but not limited to, **quantum computing, artificial intelligence, computational thinking, cybersecurity, environmental science, and STEM entrepreneurship.**

- ITEST welcomes proposals with well-designed **strategies to integrate these emerging areas into effective learning and pedagogical innovations**.

The wide range of ITEST funded projects

ITEST funds proposals situated in

both formal and informal educational setting.

ITEST proposals are submitted by

university faculty, and STEM educational leaders and researchers from other organizations such as museums, libraries, etc. PIs are encouraged to work with PreK-12 schools, informal learning organizations or other related organizations to develop ideas for their proposed activities.

University faculty members and students

can receive stipends as they do for other research programs

ITEST Supports

- experiences in any location and any time that match with the goal of supporting increased participation in STEM education and potential careers.

- projects at schools, community locations, museums and science centers, or at university or industry sites, and occur before, during, or after regular school hours as well as in the summer or on weekends as appropriate for the project's goals.

Approaches to Equitable ITEST Program Design & Research

- Build on individual and community knowledge and cultural strengths
- Build on strengths through co-creation or collaborative design
- Share power with the community by including it "at the table" from the beginning
- Involve the community in determining what useful project knowledge can be developed from research and evaluation
- Add value to the community by adequately compensating the community and participants for their involvement and by sharing project knowledge with the community
- Incorporate these perspectives as relevant in your project narrative in the context of the three ITEST Pillars, Solicitation Specific Review Criteria, and Budget.

ITEST has Three REQUIRED Pillars

ITEST Projects

Partnership

Equity

Technology

Pillar 1: Integrating Technology in Learning
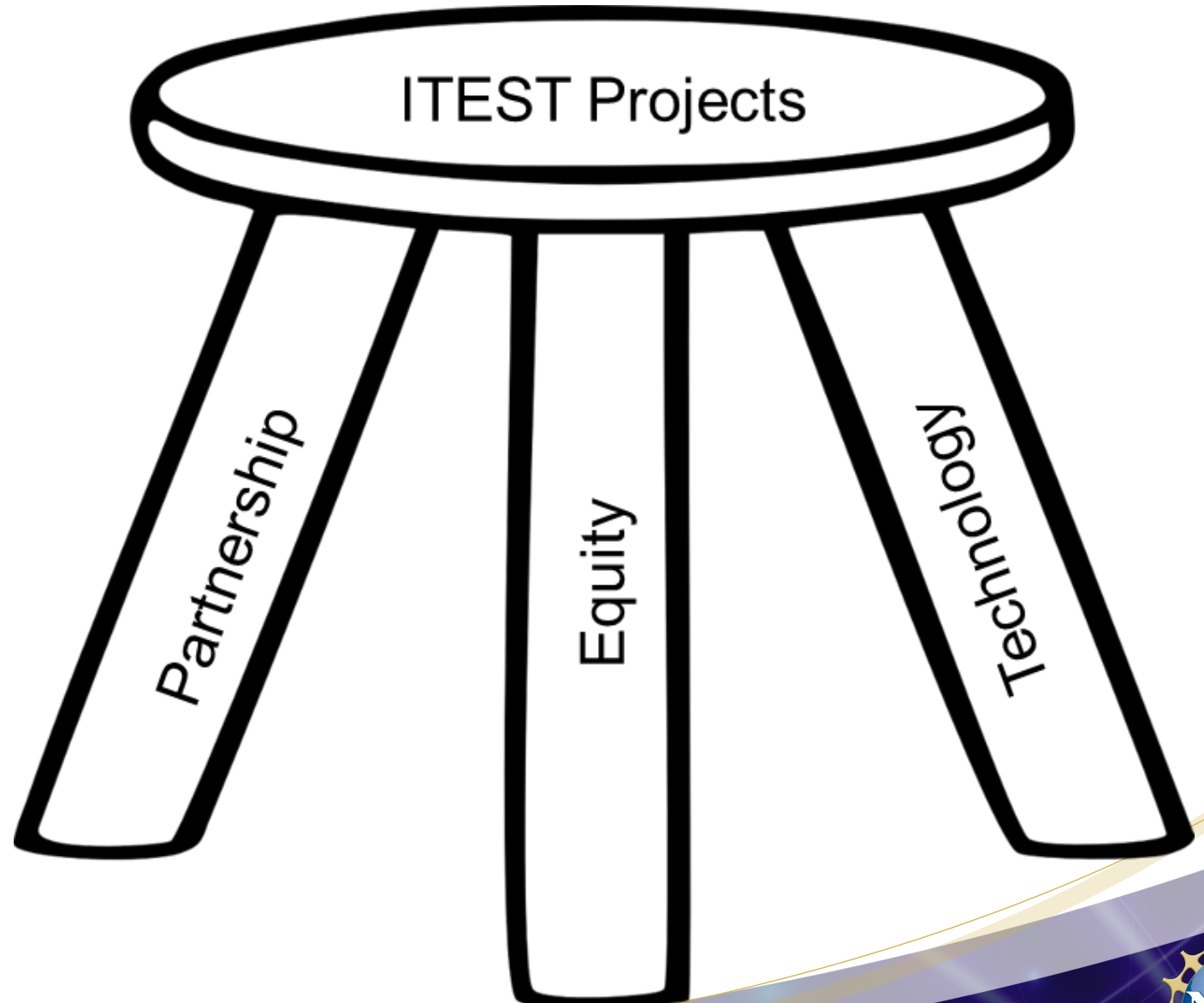
ITEST requires that proposed activities engage learners in the use of technologies that will support foundational preparation in STEM and information and communication technologies.

When responding to this Pillar consideration should be given to:

- The design features of the technology.
    - Why choose this technology? What is the evidence or literature that supports this technology choice for this population, setting, and content?
- How specific STEM disciplinary concepts will be taught.
    - How does the technology support this instruction?
- How use of the proposed technology will be supported.
    - How will it be integrated into the learning environment? How will instructors/teachers/facilitators be supported via the technology design and/or via professional development?
- What will be studied?
    - Which aspects of the technology or its deployment are novel? What outcomes will be attended to, and for whom?

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** to support students' awareness and preparation for STEM/ICT careers.

- **Opportunities** may include: entrepreneurship, apprenticeships, externships, internships, and mentoring

- **Community stakeholders** may include: neighborhood or community groups, nonprofit or philanthropic organizations, businesses, libraries, museums, educational institutions, and other agencies.

The voices, knowledge, values, diverse perspectives and experiences of individuals who have been underrepresented and/or underserved in STEM should be considered to play a key role (e.g., project leadership, research positions, conceptualization of the partnership, decision-making processes, and interpretation and dissemination of evidence and research results). Proposals should:

- Describe how partnerships will strengthen existing collaborations and/or develop new connections between partners

- Specify how partnerships directly engage the target audience(s)

- Discuss the collaborative theory of action, how it is being implemented, and the ways in which the partnership will benefit target audience(s) and stakeholders. The theory of action should speak to how trust is developed among partners in order to identify and negotiate differences between policies and culture.
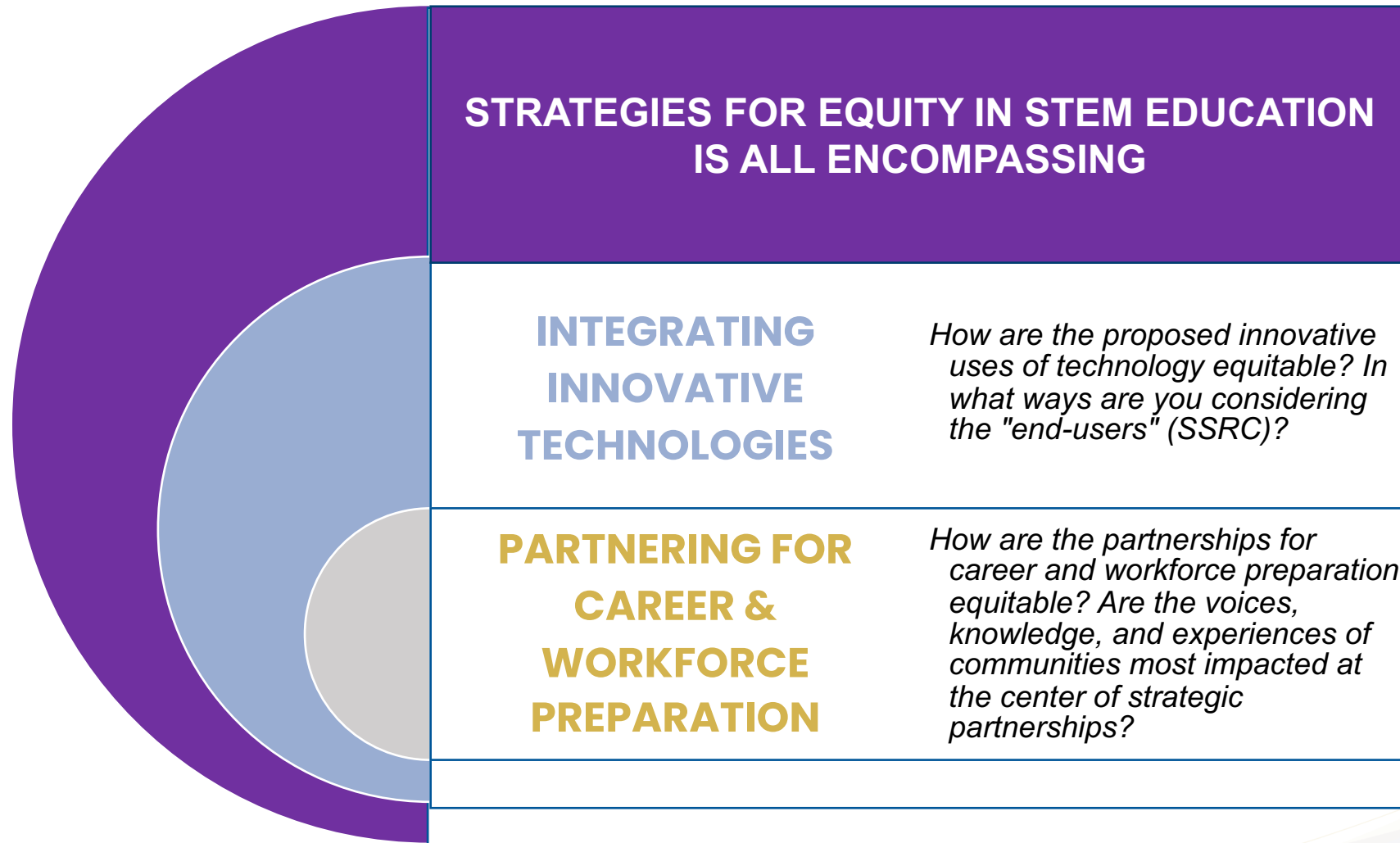
Pillar 3: Strategies for Equity in STEM Education

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

1. **Operationalizing.** Which specific audience(s) are being supported, and what inequities do they face that the proposed strategies seek to address?

2. **Conceptualizing.** How are your strategies for equity in STEM exploring (ETD) or building (DTI) on theories, methodologies, and/or design principles?

3a. **Connecting to Pillar 1.** How is that technology engaging and effective for the target audience, given their unique assets and histories?

3b. **Connecting to Pillar 2.** Are the voices, knowledge, and experiences of communities who will be most impacted at the center of strategic partnerships?

Pillar 3: Strategies for Equity in STEM Education

STRATEGIES FOR EQUITY IN STEM EDUCATION IS ALL ENCOMPASSING	
INTEGRATING INNOVATIVE TECHNOLOGIES	*How are the proposed innovative uses of technology equitable? In what ways are you considering the "end-users" (SSRC)?*
PARTNERING FOR CAREER & WORKFORCE PREPARATION	*How are the partnerships for career and workforce preparation equitable? Are the voices, knowledge, and experiences of communities most impacted at the center of strategic partnerships?*

NSF

Solicitation Specific Review Criteria - Required in proposal narrative

To what extent does the proposal:

1. Include explicit and adequate strategies for recruiting and selecting participants

2. Describe approaches to address diversity, access, equity, and inclusion

3. Describe research-informed instructional approaches to build on strengths and challenges of the target audience

4. Explain how innovations with technology are developmentally and age-appropriate

Research and Evaluation

Research and Evaluation

Relates to the *<u>Merit Review Criteria</u>* *questions:*

What is the potential for the proposed activity to advance knowledge and understanding within its own field or across different fields ?

Does the plan incorporate a mechanism to assess success?

Relation between Research and Evaluation

Objectives of Research

- Developing understanding of the project elements, processes and outcomes
- Developing valid and reliable measures of important learning processes and outcomes for students and teachers
- Addressing fundamental questions or issues significant to the field
- Advancing new knowledge and evidence base on important questions

Objectives of Evaluation

- Is the project making satisfactory progress toward its goals?
  - Recommending evidenced-based adjustments to project plans.
- To what extent are the products and processes effective?
  - Attesting to the integrity of outcomes reported by the project.

Key Elements of an Evaluation Plan

Kinds of Evaluation

- **Formative** approaches that guide the project through its development and implementation, yielding suggestions for how the work might be improved.
  - *Internally* focused.
- **Summative** approaches that provide evidence to demonstrate whether the approach worked as intended.
  - *External* analysis.

Project Evaluation Personnel

- **Advisory Board**: Internal analysis; Formative advising, Especially appropriate for Exploratory and early-stage work.

- **External Evaluator**: Formative and summative analysis of project implementation and results; Strongly recommended for design & development studies.

- Resources available at the ITEST Resource Center website: https://stelar.edc.org/search#evaluation

- Additional resources at https://www.informalscience.org/evaluation

Key Elements of a Research Plan

A well-constructed research plans contain:
- An overview of relevant research that establishes:
  - The rationale for the importance and validity of the research
  - The rationale for the design of the learning experience
  - The potential of the proposed research to contribute new knowledge to the field

- Research questions that are clear, specific and can be investigated empirically

- Specific plans for collecting quantitative and/or qualitative data that can inform the research questions
  - Justification for why the proposed research methods are valid and aligned with the research questions

- A description of the research team's roles and expertise.

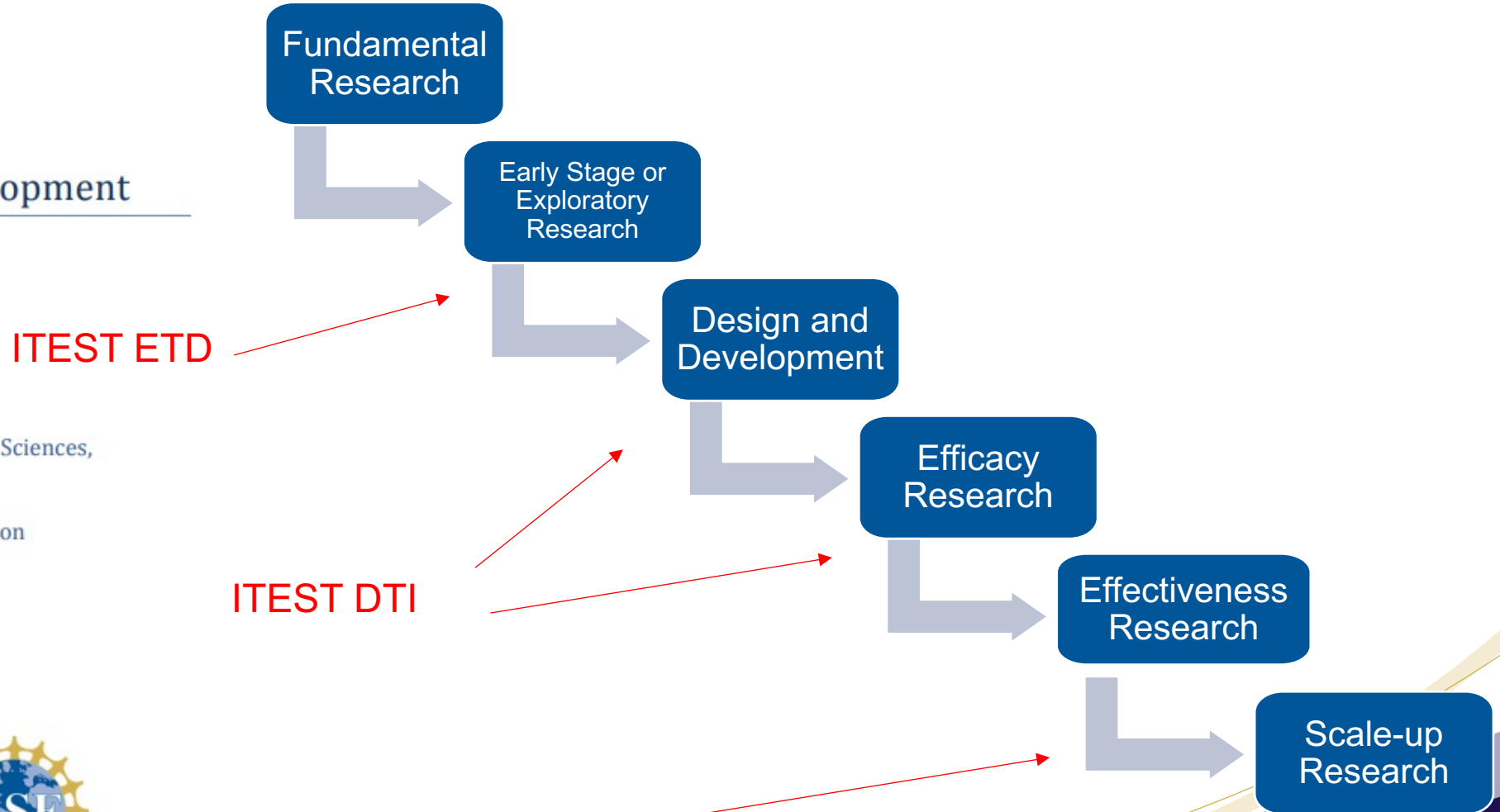# Project Types & Funding Levels

Project Types & Funding Levels

Conference or Workshop Projects	Synthesis Studies	Exploring Theory and Design Principles (ETD)	Designing and Testing Innovations (DTI)	Scaling, Expanding, and Iterating Innovations (SEI)
Up to 1 year	Up to 2 years	Up to 3 years	Up to 4 years	Up to 5 years
Up to $100,000	Up to $400,000	Up to $500,000	Up to $1,300,000	Up to $3,500,000
• Establish timeliness/value to community of the identified issue • Describe expertise and selection criteria for participants • Include conceptual framework • Include draft agenda • Describe expected outcomes & dissemination	• Focus on a question, issue, or topic of critical importance to ITEST pillar(s) • Present current state of knowledge • Explain or justify methods. May include literature reviews, qualitative meta-syntheses, meta-analyses • Generate products useful by researchers and practitioners	• Investigate conditions in the field • Explore factors intended to increase knowledge and interest • Research should build and advance theory, produce design principles or frameworks for innovations	• Design and test or implement the innovation • Analyze outcomes • Research should attend to how the design principles influence knowledge and interest in STEM careers or pathways	• Broaden an innovation at a significant scale • Extend innovation to new populations, regions, ages, contexts • Research should be transferable and generalizable to scale Assess cognitive & soc-emo outcomes, STEM/ICT knowledge & or career pursuit
Proposers should contact a program officer prior to submission.				

Conceptualizing Project Types

NSF 13126

Common Guidelines for
Education Research and Development

A Report from the Institute of Education Sciences,
U.S. Department of Education

and the National Science Foundation

August 2013

Fundamental Research → Early Stage or Exploratory Research → Design and Development → Efficacy Research → Effectiveness Research → Scale-up Research

ITEST ETD

ITEST DTI

ITEST SEI

https://www.nsf.gov/pubs/2013/nsf13127/nsf13127.jsp

EMERGING WORFORCE PRIORITIES

- AI
- Data Science
- Computational Thinking
- Quantum Information Science and Engineering
- Semiconductor/Microelectronics

Encouraging EPSCOR Applicants

- EPSCoR: **E**stablished **P**rogram to **S**timulate **Co**mpetitive Research
  - EPSCoR program pursues a mission to enhance the research competitiveness of targeted jurisdictions
- Eligible states:
  - Alabama, Alaska, Arkansas, Delaware, Guam, Hawaii, Idaho, Iowa, Kansas, Kentucky, Louisiana, Maine, Mississippi, Montana, Nebraska, Nevada, New Hampshire, New Mexico, North Dakota, Oklahoma, Puerto Rico, Rhode Island, South Carolina, South Dakota, Vermont, US Virgin Islands, West Virginia, and Wyoming
- EPSCoR likes funding projects that:
  - Catalyze the development of research capabilities
  - Establish sustainable STEM education, training, and professional development pathways
  - Broaden direct participation of diverse individuals, institutions, and organizations
  - Support sustainable engagement of project participants and partners through data-sharing, communication, outreach, and dissemination
  - Impact research, education, and economic development beyond the project at academic, government, and private sector levels
- For more information:
  https://new.nsf.gov/funding/initiatives/epscor
  https://new.nsf.gov/funding/initiatives/epscor/2023-epscor-pi-meeting

General inquiries regarding this program and program solicitation should be made to: DRLITEST@nsf.gov

What should you do if you have a specific inquiry regarding your project or proposal?

Using the email address above, in the body of the email or as in attachment, send a brief (max 2 pages) summary of the research or R&D you are planning to conduct. The synopsis should include a very brief rationale for the work, how it will contribute to the knowledge base **on STEM teaching and learning**, and what you believe the broader impacts to be. Be sure to also include your specific questions.

We look forward to receiving your proposals

Solicitation:

https://www.nsf.gov/pubs/2022/nsf22585/nsf22585.pdf

Full Proposal Deadline: August 09, 2024
(due by 5 p.m. submitter's local time):

NSF 24-500: Innovative Technology Experiences for Students and Teachers (ITEST) Resource Center

- This new solicitation calls for a Resource Center for the ITEST program.
- The Resource Center will support diverse, multi-sector stakeholders in actualizing the three pillars of ITEST.
- This Resource Center will facilitate individual and collective dialogue, reflection, and action relative to these pillars, while supporting stakeholders in the conceptualization, actualization, and communication of ITEST projects.
- Proposals involving multiple organizations are highly encouraged.
- Funding Amount: up to $5,000,000 for up to 5 years
- Full Proposal Deadline: January 22, 2024