

IMPROVING UNDERGRADUATE STEM EDUCATION (IUSE)

Improving Undergraduate STEM Education Funding (Dollars in Millions)

	FY 2022 Actual	Disaster Relief			FY 2024 Request
		FY 2023 Estimate Base	Supplemental CHIPS + Science	FY 2023 Estimate Total	
BIO	\$2.12	\$1.50	-	\$1.50	\$5.00
CISE	0.57	3.00	-	3.00	3.00
EDU	93.50	93.50	32.10	125.60	93.50
ENG	-	5.00	-	5.00	6.65
Total	\$96.20	\$103.00	\$32.10	\$135.10	\$108.15

Overview

High-quality undergraduate STEM education is essential for preparing the diverse, domestic STEM workforce needed to sustain U.S. leadership in innovation.^{1,2} It is critical for producing STEM-knowledgeable and proficient workers who can use STEM skills in business, industry, and other sectors as well as a STEM-literate public that understands and benefits from STEM.³ Furthermore, to respond to the shifting demands of convergence, demographic and societal changes, workforce adaptations, and technological advancements, the IUSE program aims to ensure that every student experiences high-quality learning opportunities and exceptional teaching in their STEM courses.⁴

To achieve this goal, the NSF-wide IUSE initiative invests in investigators and research and development projects that aim to improve undergraduate STEM education, ranging from individual STEM classrooms to nationwide STEM systemic efforts. Further, IUSE encourages proposal submissions focusing on innovative undergraduate STEM education that prepare the STEM workforce in interdisciplinary areas, such as computational and data-enabled science and engineering. It also solicits proposals in emerging fields, such as AI, Quantum Information Science (QIS), biotechnology, and critical industries, such as semiconductors and microelectronics. All IUSE projects must include assessment components and also must contribute new or expand knowledge about effective teaching and learning practices in undergraduate STEM education that can spur future innovations.

IUSE is one of EDU's core STEM education programs, soliciting for novel, creative, and transformative

¹ National Science Board (2018). Our Nation's Future Competitiveness Relies on Building a STEM-Capable U. S. Workforce. Retrieved from: www.nsf.gov/nsb/sei/companion-brief/NSB-2018-7.pdf

² Hulten, C. (2017). The Importance of Education and Skill Development for Economic Growth in the Information Era. In *Education, Skills, and Technical Change: Implications for Future US GDP Growth*. University of Chicago Press. Retrieved from: www.nber.org/chapters/c13937

³ National Academies of Sciences, Engineering, and Medicine. (2016). *Science literacy: Concepts, contexts, and consequences*. National Academies Press. Retrieved from: www.nap.edu/catalog/23595/science-literacy-concepts-contexts-and-consequences

⁴ National Academies of Sciences, Engineering, and Medicine. 2022. *Imagining the Future of Undergraduate STEM Education: Proceedings of a Virtual Symposium*. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26314>.

projects that have immense potential of producing new or expanded knowledge to improve STEM education for undergraduate students at both two- and four-year institutions, including Minority Serving Institutions (MSIs) and broad access institutions. In addition to supporting projects that have specific relevance to any NSF-supported discipline, it also funds projects that span all STEM disciplines. Examples of such cross-cutting efforts include incorporating active learning, institutional and community transformation, increasing access to undergraduate research experiences, and developing courses and instructional materials using emerging technologies (e.g. AI, augmented and virtual reality, etc.). This flexibility enables IUSE to respond rapidly to emerging STEM areas and Administration priorities. For example, in FY 2023, IUSE contributed to the Future of Semiconductors program, supporting projects that cultivate a broad coalition of researchers from across science and engineering communities to use a holistic, co-design approach to fundamental research, education, and training and to enable rapid progress in new semiconductor technologies. In FY 2024, IUSE anticipates continuing its investments to support innovations in the two-year college STEM education⁵ sector, which encourage investigators and projects to (1) center students in the effort to advance innovation and promote equitable outcomes in STEM education at two-year colleges, and (2) enhance the capacity of two-year colleges to harness the talent and potential of their diverse student and faculty population through innovative disciplinary, multi-department, and college-wide efforts. With more than 1,000 two-year colleges enrolling over 11 million students, these institutions provide STEM education to a large population of students entering the STEM workforce and are critical to our STEM competitiveness. Among U.S. students who earned Science & Engineering bachelor's degrees between 2010 and 2017, about half (47 percent) had done some coursework at a community college and nearly a fifth (18 percent) earned associate degrees.

IUSE was initiated as a multi-year, NSF-wide priority investment area, originally spanning FY 2014 to FY 2020. Now, in its tenth year, the program continues to promote novel, creative, and transformative approaches to generating and using new knowledge about STEM teaching and learning that lay the groundwork for institutional improvement in STEM education. In addition, the program continues to improve diversity of students and faculty participation in STEM education, and knowledge mobilization and adoption of new and effective pedagogical practices. The IUSE program demonstrates NSF's substantial commitment to the highest caliber of undergraduate STEM education utilizing the Foundation-wide framework of investments. It is also closely aligned with the agency's priority to inspire the Missing Millions in STEM, better serving and meeting the teaching and learning needs of those student populations often under-cultivated and underserved in STEM.

Goals

IUSE supports improvements in undergraduate STEM education across the Nation by funding research, development, and implementation efforts that will:

1. *Improve Undergraduate STEM Learning and Learning Environments:* Investments will build the knowledge base for innovative undergraduate STEM instruction and evidence-based pedagogical and professional development practices.
2. *Broaden Participation and Institutional Capacity for Undergraduate STEM Learning:* Investments will increase the number and diversity of undergraduate students in STEM majors and career pathways and build the knowledge base for how to do so.

⁵ <https://beta.nsf.gov/funding/opportunities/advancing-innovation-and-impact-undergraduate-stem-education-two-year>

3. *Build the STEM Workforce for Emerging Industries:* Investments will advance the preparation of undergraduate students to be successful in today's STEM classrooms and, equally important, productive members of the future STEM and STEM-capable workforce.

FY 2024 Investments

As part of ISUE's mission to advance STEM, NSF plans to invest \$108.15 million in IUSE in FY 2024. It is one of the anchor undergraduate investments made by EDU, supporting research and development activities, such as studying the use of inquiry-based and active learning approaches in undergraduate instruction, increasing undergraduate research experiences and courses, and research on the persistence and graduation of students in STEM programs. IUSE is complemented by six additional EDU core programs, sharing three common IUSE goals listed in the previous section but have more specific funding goals than IUSE: EDU:

- EDU – *IUSE: Hispanic Serving Institutions (HSI) Program:* Funds improvements in retention and graduation rates at HSIs that have not received high levels of NSF support; Estimated Number of Awards: 40.
- EDU – *IUSE: Innovations in Two Year College STEM Education (ITYC):* Supports STEM education initiatives which enhance STEM teaching and learning at two-year colleges; Estimated Number of Awards: 20.
- BIO – *IUSE: Research Coordination Networks/Undergraduate Biology Education (RCN-UBE):* Encourages collaborative networks to improve undergraduate biology education; Estimated Number of Awards: 12.
- ENG – *IUSE/Professional Formation of Engineers: Revolutionizing Engineering Departments (IUSE/PFE:RED):* Supports organizational change strategies to transform undergraduate engineering education; Estimated Number of Awards: 5 to 10.
- CISE – *IUSE: Computing in Undergraduate Education (IUSE:CUE):* Champions collaborative partnerships to re-envision how to teach computing effectively in a scalable manner focusing on those undergraduate students from groups underserved by traditional computing courses and careers; Estimated Number of Awards: 6.
- GEO – *IUSE: Pathways into the Geosciences - Earth, Ocean, Polar and Atmospheric Sciences (GEOPATHs):* Supports projects that specifically address the current needs and opportunities related to education, learning, training and professional development within the geosciences community through the formation of STEM Learning Ecosystems that engage students in the study of the Earth, its oceans, polar regions and atmosphere; Estimated Number of Awards: 15.

IUSE funding focuses on advancing the Nation's vision of an undergraduate STEM education enterprise in which every undergraduate becomes STEM-knowledgeable and all students who desire to can pursue a STEM education that maximizes their full potential for a STEM career.