IMPROVING UNDERGRADUATE STEM EDUCATION (IUSE) **$102,500,000**
+$400,000 / 0.4%

Overview

Improving Undergraduate STEM Education (IUSE) is an NSF-wide activity that supports both research about and implementation of high-quality undergraduate education in science, technology, engineering and mathematics (STEM), including computer science. High-quality undergraduate STEM education is vital to preparing a diverse professional STEM workforce that is equipped to sustain U.S. leadership in STEM innovation.[1,2] For example, STEM-related occupations represent about six percent of total U.S. employment[3] and the demand for workers in STEM-related occupations is expected to continue to grow at higher than average rates. Further, the average wage of STEM occupations is nearly double that of non-STEM occupations.[4] In addition to preparing the STEM workforce, high-quality undergraduate STEM education is also critical for producing STEM-knowledgeable workers who can use STEM skills in business and industry, and a STEM-literate public that supports and benefits from the progress of science.[5] By investing in improving the quality and effectiveness of undergraduate STEM education, IUSE directly contributes to national STEM needs and our scientific understanding of undergraduate STEM learning and learning environments.

IUSE can support projects in any NSF directorate, enabling IUSE to coordinate NSF investments in undergraduate STEM education across the Foundation. This coordination increases the potential impact of NSF investments in undergraduate education. IUSE supports investigators in a particular discipline to address discipline-specific issues, such as the need to recruit more women and minorities into computer science. IUSE investigators also contribute to issues that are relevant across all disciplines, such as incorporating active learning approaches.[6] The cross-directorate coordination provided by IUSE also supports science-driven innovations in undergraduate education, such as those needed to produce a STEM workforce that can use interdisciplinary approaches and/or massive data sets to identify and solve problems.

As part of its mission to advance STEM, NSF plans to invest $102.50 million in FY 2019. This funding represents investments within and across directorates, and is aligned with the IUSE funding strategies framework and the IUSE goals.

Goals

NSF undergraduate investments target one or more of the following three IUSE goals:

1. Improve STEM learning and learning environments at the undergraduate level. These investments improve the knowledge base for defining, identifying, and implementing innovative undergraduate STEM instruction that leads to improved student learning and fosters widespread use of evidence-based

[1] 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.pdf

[2] Olson, S., & Riordan, D. G. (2012). Engage to Excel: Producing One Million Additional College Graduates with Degrees in Science, Technology, Engineering, and Mathematics. Report to the President. Executive Office of the President. https://obamawhitehouse.archives.gov/sites/default/files/microsites/ostp/pcast-engage-to-excel-final_2-25-12.pdf.

[3] www.bls.gov/opub/ted/2017/8-point-8-million-science-technology-engineering-and-mathematics-stem-jobs-in-may-2016.htm?view_full

[4] www.bls.gov/spotlight/2017/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future/pdf/science-technology-engineering-and-mathematics-stem-occupations-past-present-and-future.pdf

[5] 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

[6] Freeman, S., et al. (2014). Active learning increases student performance in science. Proceedings of the National Academy of Sciences. 111: 8410-8415. Retrieved from: www.pnas.org/content/111/23/8410.abstract

resources and pedagogies in undergraduate STEM education.
2. Broaden participation and institutional capacity for STEM learning. These investments increase the number and diversity of undergraduate students recruited and retained in STEM fields and career pathways by implementing evidence-based, successful strategies to broaden participation and by growing that evidence base.
3. Build the STEM workforce for tomorrow. These investments improve the preparation of undergraduate students so that they can succeed as productive members of the future STEM and STEM-capable workforce, regardless of career path, and be engaged as members of a STEM-literate society.

The IUSE initiative's anchor investment is IUSE: Education and Human Resources (IUSE: EHR), a solicitation-based program in the EHR Division of Undergraduate Education (DUE). IUSE: EHR funds (1) innovative learning resources; (2) design of research questions to understand the impact of such resources; (3) strategies to implement effective instruction in a department or multiple departments, within or across institutions; (4) faculty development projects; (5) design and testing of instruments for measuring student outcomes; and (6) innovative activities that could have a high impact on learning and contribute to transforming undergraduate STEM education.

IUSE: EHR is complemented by five additional IUSE core programs:
- IUSE: Hispanic Serving Institutions (HSI Program);
- BIO: Research Coordination Networks: Undergraduate Biology Education (RCN: UBE);
- ENG: IUSE/Professional Formation of Engineers: REvolutionizing engineering Departments (IUSE/PFE: RED);
- CISE: innovation in undergraduate computer science education that enables, in part, the diffusion of computational thinking and computer science across a broad array of other fields (i.e. "CS+X").
- GEO/IUSE: Pathways into Geoscience (IUSE: GEOPATHS).

Together with IUSE: EHR, these six programs form the core of the IUSE framework of investments.

Improving Undergraduate STEM Education (IUSE)
Funding Levels
(Dollars in Millions)

Dir/Office	FY 2017 Actual	FY 2018 (TBD)	FY 2019 Request
BIO	$1.82	-	$2.00
CISE	1.99	-	2.00
EHR	87.01	-	87.00
ENG	4.97	-	5.00
GEO	6.31	-	6.50
Total	**$102.10**	**-**	**$102.50**