

**NATIONAL SCIENCE FOUNDATION (NSF)
COMPUTER SCIENCE EDUCATION RESEARCH CONGRESSIONAL REPORT
IN COMPLIANCE WITH PUBLIC LAW 114-329:
AMERICAN INNOVATION AND COMPETITIVENESS ACT, SEC. 310 (E)**

Summary

The American Innovation and Competitiveness Act, 2017, Public Law 114-329, requires the National Science Foundation (NSF) to undertake specific activities regarding computer science education research (Sec. 310):

“(b) GRANT PROGRAM. —

- (1) IN GENERAL. — The Director of the Foundation shall award grants to eligible entities to research computer science education and computational thinking.
 - (2) RESEARCH. — The research described in paragraph (1) may include the development or adaptation, piloting or full implementation, and testing of —
 - A. models of preservice preparation for teachers who will teach computer science and computational thinking;
 - B. scalable and sustainable models of professional development and ongoing support for the teachers described in subparagraph (A);
 - C. tools and models for teaching and learning aimed at supporting student success and inclusion in computing within and across diverse populations, particularly poor, rural, and tribal populations and other populations that have been historically underrepresented in computer science and STEM fields; and
 - D. high-quality learning opportunities for teaching computer science and, especially in poor, rural, or tribal schools at the elementary school and middle school levels, for integrating computational thinking into STEM teaching and learning.
- (c) COLLABORATIONS. — In carrying out the grants established in subsection (b), eligible entities may collaborate and partner with local or remote schools to support the integration of computing and computational thinking within pre-kindergarten through grade 12 STEM curricula and instruction.
- (d) METRICS. — The Director of the Foundation shall develop metrics to measure the success of the grant program funded under this section in achieving program goals.
- (e) REPORT. — The Director of the Foundation shall report, in the annual budget submission to Congress, on the success of the program as measured by the metrics in subsection (d).
- (f) DEFINITION OF ELIGIBLE ENTITY. — In this section, the term “eligible entity” means an institution of higher education or a non-profit research organization.”

Background

NSF’s Computer Science for All (CSforAll) activities address the national need to build computer science education opportunities and teacher preparation at the preK-12 level, as part of building the U.S. economy. Projects are expected to address equity issues in computer science education, including the participation of girls and women and other groups historically under-represented in computing, including some racial or ethnic identities, students with disabilities, students from economically disadvantaged backgrounds, and more.

NSF launched Computer Science for All: Researcher Practitioner Partnerships (CS for All: RPP) under the (STEM+C) program in 2017 with solicitation NSF 17-525¹. In 2018, NSF issued an updated solicitation (NSF 18-537)² making CSforAll a stand-alone program. In 2020, NSF issued an updated solicitation Computer Science for All (CSforAll: Research and RPPs), NSF 20-539³. As the new name suggests, this updated solicitation added a focus on research to serve the goals of the program. Specifically, a new research strand was added to support projects designed to contribute new knowledge to the educational field about the teaching and learning of introductory computer science concepts.

The CS for All: Research and RPPs program synopsis in the program solicitation states that:

This program aims to provide all U.S. students with the opportunity to participate in computer science (CS) and computational thinking (CT) education in their schools at the preK-12 levels. With this solicitation, the National Science Foundation (NSF) focuses on both research and researcher-practitioner partnerships (RPPs) that foster the research and development needed to bring CS and CT to all schools. Specifically, this solicitation aims to provide (1) high school teachers with the preparation, professional development (PD) and ongoing support they need to teach rigorous computer science courses; (2) preK-8 teachers with the instructional materials and preparation they need to integrate CS and CT into their teaching; and (3) schools and districts with the resources needed to define and evaluate multi-grade pathways in CS and CT.

Metrics

Short-, mid-, and longer-term metrics for success are considered by the program as follows:

- Short-term metrics focus on ensuring that the program is making awards in the four areas outlined in the law and that the awards address the goal of broadening participation in computer science. One indicator of broadening participation is the diversity of the intended populations to be reached by the awards. CSforAll considers 'short-term' metrics to be those which are observable on an annual basis. To date, the program has only reported progress with respect to these short-term metrics.
- Mid-term metrics include the extent to which funded projects are achieving goals as measured by the progress reported in NSF's required annual and final project reports. CSforAll operationalizes 'mid-term' as progress that individual projects can reasonably be expected to achieve within three years of award.
- Longer-term (beyond five years) metrics will include an evaluation of the outcomes of the program, which are based on the program aims as described in the program solicitation and the well-aligned requirements of Public Law 114-329. Program staff will work with the Evaluation and Monitoring Group within NSF's Directorate for STEM Education and the Evaluation and Assessment Capability within NSF's Office of Integrative Activities to develop (1) a set of specific longer-term metrics and (2) a program evaluation plan for assessing the collective success of the CS for All: RPP projects using these longer-term metrics.

¹ www.nsf.gov/pubs/2017/nsf17525/nsf17525.htm

² www.nsf.gov/pubs/2018/nsf18537/nsf18537.htm

³ www.nsf.gov/pubs/2020/nsf20539/nsf20539.htm

Report on the Success of the Program as Measured by the Short-Term Metrics

During FY 2022, the program funded 17 new projects comprised of 21 awards to proposals submitted pursuant to NSF 20-539. These awards have goals that cover the first three research topics listed in Sec. 310 of the Act as outlined below. Because some awards have goals that span more than one of the research topics addressed in (b)(2) A, B, and C, the number of projects sums to more than 17.

- 15 projects have research goals on preservice preparation and ongoing professional development for teachers that address subsection (b)(2) A and (b)(2) B
- 17 projects have research goals on tools and models for teaching and learning that address subsection (b)(2) C
- 3 projects have research goals that address multi-grade pathways to CT and CS

Examples of CSforAll-supported efforts to address the developments or adaptation, piloting or full implementation, and testing of models of preservice preparations for teachers who will teach computer science and computational thinking and/or scalable and sustainable models of professional development and ongoing support for these teachers, can be found at the CSforAll program website⁴. Taken as a group, these awards consider a range of opportunities to expand CS education and computational literacy. These include methods for sustainable scaling using school and district networks, and regionally-focused K-12 efforts. Projects also engage a broader cross-section of students in CS education through place-based strategies and lessons connected to local communities.

With respect to subsection (b)(2) D, all 17 new awards have explicit statements and plans to address at least one underrepresented or underserved group included in the project descriptions. The specific groups addressed by these 17 awards are detailed in the following table. Thus, because some awards serve more than one underrepresented group, the number of awards sums to more than 17. Additionally, the geographic spread of CSforAll awards can be viewed on NSF's website⁵.

Underrepresented or Underserved Groups Served by Backbone Organizations

Category	Number of awards serving
Latino/a	10
Low Socio-Economic Status	10
African Americans	8
Women/Girls	6
English Language Learners	5
Persons with Disabilities	4
Native Americans	2
Native Hawaiians & Pacific Islander	-

⁴ Computer Science for All (CSforAll: Research and RPPs) | Beta site for NSF - National Science Foundation; <https://beta.nsf.gov/funding/opportunities/computer-science-all-csforall-research-and-rpps>

⁵ Computer Science For All Active Awards; www.nsf.gov/awards/award_visualization.jsp?org=NSF&pims_id=505359&ProgEleCode=005Y%2C134Y&from=fund#

Report on the Success of the Program as Measured by the Mid-Term Metrics

Mid-term metrics assess progress that individual projects can reasonably be expected to achieve within three years of award. Measurement of mid-term metrics is based on information contained in projects' annual reports. Since we are reporting on FY 2022, mid-term metrics are given for the 25 awards that NSF issued in FY 2019.

In their annual reports, awardees are requested to provide information about the progress of their individual projects:

- What are the major goals of the project?
- What was accomplished under these goals and objectives? What were the major activities, the specific objectives, significant results, and key outcomes?
- What opportunities for training and professional development has the project provided?
- Have the results been disseminated to communities of interest?
- What do you plan to do during the next reporting period to accomplish the goals?

Based on the responses of the awardees, program staff assessed that 100 percent of projects awarded in FY 2019 have been making satisfactory progress for each year of the project duration. "Satisfactory progress" refers to criteria such as whether the stated goals of the project are being met; whether the major activities are in line with those planned in the original grant proposal; whether the opportunities for training and professional development are in line with those promised; and whether dissemination is occurring as planned. Projects voluntarily included information about the number of teachers reached. For example, the 25 awarded projects from FY 2019 reported a total of approximately 922 teachers, and the aggregated information from individual projects suggested that CSforAll is successful in the mid-term.

Report on the Success of the Program as Measured by the Longer-Term Metrics

In FY 2023, program staff is consulting with colleagues in NSF's Evaluation and Assessment Capability and the Directorate for STEM Education to identify metrics for assessing outcomes of the program's support for (a) preparation and ongoing professional development for high school teachers who provide instruction in computer science, and (b) instructional materials and preparation for K-8 teachers who integrate computer science and/or computational thinking into their teaching. With this in mind, NSF will employ these metrics in periodic evaluations of long-term program outcomes. To date, only one cohort of awards (those made in FY 2017) have reached the 'longer-term' (beyond five years) benchmark. Further, to provide more robust information on typical outcomes at the five-year mark across cohorts, NSF will commission an independent third-party evaluation in FY 2024.