

**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 educational equity issues in computer science education, including the participation of girls and women, as well as other groups historically underrepresented in computing, such as 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 17-525.¹ 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 20-539.³ 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:

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.
- 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.

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

- 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. In FY 2023, program staff worked 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 discuss specific metrics for documenting longer-term outcomes and impacts, and prepare a requirements statement for an independent evaluator to develop these metrics and use them to assess the collective success of the CS for All: RPP projects. A contract has been awarded and the program expects the updated metrics will be provided in an interim public report in 2024.

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

During FY 2023, the program funded 13 new projects comprised of 19 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 13.

- 12 projects have research goals that address subsection (b)(2) A and (b)(2) B;
- 13 projects have research goals that address subsection (b)(2) C; and
- 1 project has 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 website.⁴ 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. States where projects are enacted include California, Georgia, Idaho, Maryland, Massachusetts, Michigan, Minnesota, New Jersey, North Carolina, Oregon, Pennsylvania, Texas, Virginia, Washington, Wisconsin, and Wyoming.

With respect to subsection (b)(2) D, all 13 newly awarded projects have explicit statements and plans to address at least one underrepresented or underserved group included within their project descriptions. The specific groups addressed by these 13 projects are detailed in the following table. (Because some awards serve more than one underrepresented group, the number of awards sums to more than 13). In addition, the geographic spread of CSforAll awards can be viewed on NSF's website.⁵

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

**Underrepresented or Underserved Groups Served
by Backbone Organizations**

Category	Number of Awards Serving
Hispanics	8
African Americans	7
Women/Girls	4
Persons with Disabilities	4
Native Americans	4
Persons from Economically Disadvantaged Backgrounds	3
English Language Learners	3
Native Hawaiians & Other Pacific Islanders	1

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 the projects' annual reports. Since we are reporting on FY 2023, mid-term metrics are given for the 37 awards that NSF issued in FY 2020.

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 2020 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.

Of the 37 projects awarded in FY 2020, six projects were funded through the research strand and focused on building strategically instrumental, or "high leverage," knowledge about the learning and teaching of introductory computer science to support key CS and CT understandings and abilities for all students. These projects reported a total of 24 publications in the form of book chapters, journal articles, juried conference papers, and other conference presentations/papers.

The remaining projects voluntarily included information about number of teachers reached – the 31 RPP awarded projects from FY 2020 reported a total of approximately 690 teachers reached. This aggregated information from individual projects contributes to the conclusion that CSforAll is successful in the mid-term.

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

As of July 14, 2023, RTI International has been contracted by NSF to conduct the “Evaluation of CSforAll RPPs Long-term Outcomes” project, which focuses on long-term (5 years or more) outputs and outcomes associated with the 73 Researcher Practitioner Partnerships (RPPs) funded under NSF’s CSforAll RPPs initiative in FY 2017, FY 2018, and FY 2019. As part of this work, RTI International expects to publicly share interim findings in June 2024, that have been documented in reports to NSF, academic publications, websites, and publicly available databases. RTI International expects to continue to collect long-term outcomes directly from the RPP grantees during the 2024-25 school year, pending Office of Management and Budget review and approval of interview and survey protocols further to the Paperwork Reduction Act.