

Computer Science Education Research (CS-ER) Awards



Awardees

Google's [Computer Science Education Research \(CS-ER\) Awards](#) provide funding for one-year proof-of-concept pilots and a year-long cohort experience among awardees. A summary of research funded by award year.

2022 awardees

Center of Excellence for Minority Women in STEM - Spelman College

Tamara Pearson

Black Women Teaching Computer Science: The Intersection of Race and Gender and its Manifestation in the Classroom

Using a theoretical framework grounded in Black Feminist Thought and Intersectionality, this project will share the unique experiences and perspectives of Black, female, high school, computer science (BFHSCS) teachers across the United States. Our goal is to highlight the ways BFHSCS teachers address and dismantle systems of oppression within computer science education using a qualitative design of computer science autobiographies and semi-structured interviews from twenty-five (25) teachers. We hope this project will uncover the ways historical context and issues of the intersection of race and gender inform the pedagogical practice of BFHSCS teachers and understand the ways BFHSCS teachers perceive their presence as important and experiences and perspectives as unique.

(Grant No. 93661926)

Maine Mathematics and Science Alliance

Rhonda Tate

Co-designing a Computational Thinking Integration Toolkit (CT-IT) for Rural Special Educators and Paraprofessionals

The CT-IT project will explore computational thinking as a mechanism to further increase neurodiverse math learners' engagement. This project will result in the creation of sample CT integrated math lessons and the identification of professional learning supports necessary for rural districts to utilize in the integration of computational thinking in the special education curriculum. The research will answer the questions 1) What are educators' understandings about the intersection between concepts of computational thinking, mathematical practices and strengths of rural NMLs and 2) What classroom and PL activities are prioritized by educators to support understanding and implementation of these concepts by rural SEs.

(Grant No. 93661927)

CSEdResearch.org

Monica McGill, Anni Reinking, Angelica Thompson

Meta-Synthesis of K-12 CS Education Reports in the US using the CAPE Equity Framework

Major foundations and corporations have devoted significant resources to produce singular reports on K-12 Computer Science (CS) education, including Current Perspectives and Continuing Challenges in Computer Science Education in the U.S. K-12 Schools (Google/Gallup, 2020). We will explore the following research question: When viewed collectively and objectively using the equity-centric CAPE framework, what will a synthesis of findings from major reports show about equity in K-12 computer science (CS) education? We will use a critical interpretive method to synthesize these findings using the equity-centric CAPE framework and provide a report that carefully folds the findings together. This synthesis will advance the community's understanding of how capacity is equitably provided across the U.S.

(Grant No. 93661928)

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Research Alliance for New York City Schools

Kathryn Hill

Why are So Many Schools Lagging? Examining and Addressing Barriers that Hinder School's Progress Towards CS for All

To bring CS student participation to scale, the focus must shift from the few schools that were early adopters to the many that lag behind in implementation. Building on our current evaluation of NYC's CS4ALL initiative, our proposed study will illuminate the challenges faced by schools that, even after seven years of substantial resources being devoted by the district to broaden CS participation, still struggle to launch robust CS programs. What distinguishes our study from previous research is in our deeper investigation into challenges faced by lagging schools—which likely differ systematically from early adopters—and our nuanced examination of how their challenges vary by school characteristics—including school grade level and CS implementation model. Our findings will provide critical information for NYC and other cities and states across the country, guiding the development of strategies and supports tailored to the specific needs of lagging schools.

(Grant No. 93661929)

University of St. Thomas

AnnMarie Thomas

Expanding Access to Computer Science Education for Deaf and DeafBlind Students

The aim of this research is to work towards addressing the inequities in Computer Science education for Deaf and DeafBlind students. The three goals of this work are (1) The completion of an assessment of the current state of computer science and computational thinking programs and content at US Deaf schools and schools with Deaf programs, with a focus on elementary and middle school classes. (2) The co-creation (with elementary and middle school teachers) and assessment of research based Computer Science units for Deaf and DeafBlind elementary and middle school students and (3) The creation of a network of teachers from Deaf schools (and schools with Deaf programs) discussing computer science curriculum for Deaf, DeafBlind and Hard of Hearing children.

(Grant No. 93661930)

University of Minnesota

Stefanie Marshall

Do CS Heroes Wear CAPes? An Analysis of State Policy Infrastructures Designed to Support Equity-Focused Computer Science Education

In this interdisciplinary comparative case study, we examine how states have created a policy infrastructure to support the implementation of equity-focused computer science education (CSEd). This study specifically examines the CSEd infrastructures of states that have expressed a dedication to equity in state-level computing education reforms. Our study draws on qualitative research methods and social network analysis to understand policy infrastructures and the related challenges and promises as states continue to advance equity. Findings can inform equity-focused CSEd reform efforts—specifically to meet the needs of marginalized youth and support equitable CSEd within and between states.

(Grant No. 93661931)

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2021 awardees

University of Washington

Amy J. Ko

*Broadening Participation with CS
Counternarratives*

Recent CS pedagogy often uncritically frames algorithms and data as neutral, when in fact they often encode bias, embody values, and reinforce or create systems of oppression. In this project, we will explore how teachers can engage youth in secondary classrooms in examining dominant CS narratives and developing transformative counter-narratives that center issues of power and oppression. By analyzing teacher observations and pre-post student self-reports of perception and interest of CS and CS careers, we will examine the potential for CS counter-narratives to inspire youth to study CS, and then transform it.
(Grant No. 93661918)

University of Connecticut

Derek Aguiar

*Supporting Math and Science Teacher
Learning to Address Societal Problems
with Data Science and Artificial Intelligence*

This research supports grades 7-12 math and science teacher learning of data science and artificial intelligence (DS&AI) to address societal problems with big data. The project will determine the minimum requirements and tools needed to support mathematics and science certified or pre-service teachers to teach a subset of DS&AI topics and for high school students. Additionally, the project will develop and deploy three interactive DS&AI modules with support materials for teachers focusing on addressing societal problems using big data. By making DS&AI accessible to students and teachers in secondary school, and foregrounding societal issues, this project will make participation in computer science (CS) more attractive and engaging with the ultimate goal of increasing enrollment, retention, and diversity in CS.
(Grant No. 93661919)

University of California, Los Angeles

Jean Ryoo

*Understanding the CS Equity Impacts of
LAUSD's K-8 Professional Development*

Recognizing that computer science (CS) is a form of power woven tightly into the fabric of structural inequalities impacting youth, the Los Angeles Unified School District (LAUSD) has committed to ensuring CS enrollment reflects their majority-minority demographics in this second largest district in the nation, with all students receiving computing instruction by 2025. Despite nearly 3-million dollars' investment in increasing professional development (PD) offerings and reach through PDs that will remain virtual after the pandemic is over, LAUSD has been unable to study the impacts of their newer CS PDs, especially on the equity perspectives of K-8 educators charged with increasing access to computing education. Building on two decades of partnership, UCLA+LAUSD will administer surveys and interviews to understand what K-8 educators learn related to equity and computing in LAUSD's PDs. implement after PDs, and find most/least helpful in online PDs.

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(Grant No. 93661920)

Oregon State University

Jennifer Parham-Mocello

Developing Teachers' TPACK for CS Using Tabletop Games

This project explores the impact of modeling the Child's Play CS curriculum, which focuses on tabletop games, uses unplugged activities, and delays programming, on attracting and retaining K-12 teachers for teaching CS. An immediate focus on coding in CS curricula potentially discourages teachers from learning CS, integrating it into existing classes, or teaching it as an independent class or elective, creating a divide among teachers who self-identify with technology or technical subjects and teachers who do not, which can lead to fewer women and underrepresented minorities teaching CS. We are interested in using a less intimidating instructional approach for developing teachers' technological pedagogical content knowledge (TPACK) within the context of computation to help them feel more confident with adopting a K-12 CS curriculum.

(Grant No. 93661921)

The University of Texas at Austin

Joshua Childs and Tia Madkins

Where Does CS Education Reside? How School Leaders' Support Equity-Focused CS Teaching and Learning

Broadening participation in computer science has been a policy priority in many states for over a decade. However, the degree of implementation varies depending on school and district resources, knowledge, and willingness to invest in CS technology and pedagogical content. Our qualitative study examines Principals' practices that lead to creating and sustaining CS education opportunities for students, specifically for minoritized student populations.

(Grant No. 93661922)

Bluegrass Community & Technical College

Melanie Williamson and Audrey Brock

What URM/Female High School Students Know (and Don't Know) about Computer Science Careers

This research explores the factors that lead to persistence in CS as students move from high school to college. The project will analyze the influences that initially lead some students (minoritized, female) to take or avoid computing courses in high school, the impact of role-modeling by faculty mentors, and how embedded tutoring at key pinch points in the curriculum impact their decisions to continue pursuing CS in college.

(Grant No. 93661923)

Bentley University

Mounia Ziat

Mediated Tactile Signing to Support Computer Science Education for K-12 Deafblind Students

This research aims to provide access to computer science courses to Deafblind children. It reproduces and evaluates a Tactile Communicator, a combined tactile signing hardware and software platform for communication purposes. The device that can be 3D printed will be available open source to the Deafblind students and Deafblind community on the Hapticomm online platform.

(Grant No. 93661924)

College of St Scholastica

Renee Fall

Understanding Dual Credit to Expand Access to High-Quality Computer Science

More than 80% of U.S. high schools enroll students in college courses, and nearly 2 million students take part in these dual credit programs in all 50 states. Yet very few computer sciences courses are offered via dual credit. Efforts to increase the number and diversity of students earning computing degrees have too often overlooked educational opportunities and

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Education

pathways, such as dual credit, accessible to historically marginalized students. This project will study programs where CS dual credit *has* been implemented in order to identify promising practices and policy levers that could expand dual credit computer science offerings. It will also build a network of CS dual credit practitioners to contribute to and learn from the research.

(Grant No. 93661925)

Iowa State University

Kristina Tank

Rethinking Circle Time (ReCT): Examining Equity through the Integration of Computational Thinking and Literacy in K-2 Classrooms

To engage more underrepresented students in CS, we need to begin in early elementary. However, as elementary teachers have limited instructional time for subjects not tied to testing, many have suggested integrating CT into other subject areas. However, the process of integrating CT, especially with younger students, has received limited attention and resources. CT instruction needs to have more examples of how young students learn and experience CT integrated within other subjects. At the early grades, learning to read and write is a critical area of focus, with Indiana and Iowa law both suggesting at least 90 minutes of instructional time per day spent on these literacy tasks. Curriculum specialists, teachers, and educational researchers have all recognized the importance of early literacy. Therefore, by implementing additional literacy activities that integrate CT, teachers can reinforce literacy concepts, while also introducing younger students to CT content and ideas. This project will research K-2 student CT understanding as they participate in CT learning tasks integrated into literacy activities and specifically examine the equity of students' access, participation, and experiences.

(Grant No. 93661926)

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2020 awardees

University of Delaware

Chrystall Mouza

Preparing Computationally Literate Pre-Service Teachers through Professional Development for Teacher Educators

This research develops, implements and evaluates a regional collaborative partnership for infusing computational thinking (CT) across multiple pre-service teacher education programs through a set of coherent and culturally-relevant strategies engaging teacher educators and computer science experts.
(Grant No. 93661917)

University of California, Los Angeles

Jane Margolis

Let's Hear It from the Students: Students' Identity, Agency, and Engagement in Introductory High School Computer Science Classrooms

This project is part of a large-scale effort that elevates the perspectives, experiences, and voices of historically underrepresented high school CS students (rural African American students in Mississippi and low-income Latinx students in Los Angeles) who enrolled in these classes with little to no prior experience with computing. Data collected will help determine what makes a critical difference in historically underrepresented students' learning, identity, agency, and engagement in introductory CS classes (such as Exploring Computer Science and Advanced Placement Computer Science Principles).
(Grant No. 93661916)

The University of Texas at Austin

Jayce R. Warner

CS Equity Deep Dive: Examining the Correlates and Consequences of Access to and Participation in K-12 Computer Science Education

This research will inform efforts aimed at broadening participation in computer science (CS) by expanding on the ways quantitative researchers examine issues of equity. The study will use multilevel modeling to analyze statewide data for approximately 3 million students to determine what factors predict (and to what extent they predict) access to and participation in CS in middle school, high school, and college. The study will tease apart some of the complexities inherent in CS education equity research by examining many factors previously unexplored in the field and accounting for the intersection of various aspects of student identity and circumstance.
(Grant No. 93661915)

Spelman College, Center of Excellence for Minority Women In STEM

Tamara Pearson

Disrupting Mathematics as a Barrier to Computer Science through Summer Learning Opportunities

Whether real or perceived, mathematics continues to be a barrier to diversifying the computer science pipeline, especially Black students. One method for disrupting this barrier is through summer learning experiences. There are multiple factors that must be taken into consideration when designing summer learning experiences for Black students from under-resourced communities including content deficits, stereotype threat and mathematics and computer science self-efficacy. This research project examines a model for uncovering and intervening in all three of these areas.
(Grant No. 93661914)

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University of Illinois, Urbana-Champaign

Colleen M. Lewis

*Equitable Expansion of High School CS:
Trends and Trade-offs Between and Within
States*

This project builds on research on, and evaluation of, state-level CS education initiatives and particularly on work focused on equity in HS CS expansion. Specifically, it looks within and across several states to understand: the extent to which secondary CS course taking has expanded (overall and for students of different gender identities and racial backgrounds), whether CS teacher credentials have suffered as CS course offerings have expanded; whether students have equitable access to teachers in terms of qualifications or congruence of race and gender; which other courses CS courses replace; and (v) whether coursework trade-offs have implications for student achievement on standardized tests. This research will use public and administrative state data on staffing and course-taking in high schools. It will explore many trends in HS CS and how they vary across contexts and for different populations of students. Additionally, it will analyze detailed demographic, course taking, and test score data within schools over time to provide credible estimates to date of the effects of HS CS.
(Grant No. 93661913)

CSEdResearch.org

Monica McGill

*Exploring the Impact of Middle School
Computer Science Teachers Developing
Practice Briefs in Collaboration with
Researchers*

This project explores how does engaging middle school teachers in developing teacher practice briefs collaboratively with researchers and from previously published research in computing education affect their self-efficacy, classroom practices, and understanding and use of CS education research? To our knowledge, there is no literature on the impact of teachers when collaboratively writing practice briefs with researchers. Though there are few Research Practice Partnerships in the U.S. that address problems of practice teaching CS in middle schools, having teachers and researchers collaborate on creating practice briefs is a unique way to bring these two groups together. The effect of having teachers and researchers work together to create practice briefs may be similar to the benefits of bringing researchers and practitioners together to work on RPPs—raising teacher self-efficacy, increasing teacher understanding of scholarship, and a higher adoption rate of promising practices.
(Grant No. 93661912)

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Awardees

2019 awardees

Elms College, University of Michigan,
College of St. Scholastica

Beryl Hoffman, Barbara Ericson, Jennifer
Rosato

*Transitioning from AP Computer Science
Principles (CSP) to AP CS-A Java: Learning
from CSP Successes*

This research project focused on broadening participation in the AP Computer Science courses, specifically how to better prepare and support teachers and students who are new to computer science as they transition from the AP Computer Science Principles course to the more advanced AP CS A course. The researchers built on previous work to create an interactive e-book for AP CS A. This project included professional development for 36 teachers and will reach approximately 720 students in one year. (Grant No. 93661911)

Kean University

M. Bachrach, G. Verdi, P. Morreale

*Improving the Outcomes of Hispanics in
AP Computer Science*

This research aimed at improving the engagement and outcomes for Hispanic students in the AP Computer Science Principles and CSA courses. The researchers investigated whether teacher awareness of language acquisition concepts and strategies improves teaching in the classroom and also improves how well students perform in these classes. This research included professional development experiences and follow-up support for 36 teachers. (Grant No. 93661910)

Macalester College

Lauren Milne

*Accessibility in Blockly: Touch Interaction
Research*

Block-based programming environments (such as Scratch or MIT App Inventor) are often used to introduce novices to programming but because they rely heavily on visual elements and drag and drop, they are generally not accessible for children with visual or motor impairments. This project focused on improving the accessibility of the touch-based interaction with the Blockly library through adding accessibility data to the visual renderings of the blocks themselves and creating a separate interface that is designed for navigation by touch. The goal of this research was to generate an application program interface to make it easy for developers to integrate touch accessibility in their own applications. (Grant No. 93661909)

Oregon State University

Jennifer Parham-Mocell

*Integrating CS Education into Teacher
Education and K-12 Mathematics*

The goal of this research was to integrate CS education into the mathematics teacher education curriculum. The researchers worked with prospective teachers at two different stages and in two interrelated ways. First, they developed modules for undergraduate pre-service teachers (PSTs) who were enrolled in a capstone mathematics course for majors intending to be secondary teachers. These modules developed prospective teachers' knowledge of central CS concepts, and helped them understand opportunities for introducing CS concepts in their math teaching. Second, they developed modules to work with a group of master's level teacher candidates who are enrolled in a mathematics methods course. These modules helped build the teacher's CS knowledge and instructional skills and helped them design and teach CS lessons in their secondary classrooms. This research immediately impacted 50 teachers and 90 students.

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(Grant No. 93661908)

Indiana University

Anne Leftwich

*National Computer Science Education
Preservice Case Studies*

This research provided a national picture of how schools of education are preparing future teachers to teach CS in K-12 schools. The study interviewed K-12 CS education experts to develop a pathways framework, select and create multiple case studies of CS teacher education programs, and surveyed all 1,396 teacher education institutions offering traditional and/or alternative initial licensure programs. This research provided an overview of the CS education preparation landscape, examples of practices and policies being implemented in CS teaching preparation, and a public repository of the common pathways schools of education use to prepare preservice teachers to teach CS at the elementary and secondary levels.

(Grant No. 93661907)

CSforALL

Rafi Santo and Dr. Leigh Ann DeLyser

*Achieving Equity in K12 Computer Science
Implementations: Strategies, Obstacles and
Opportunities at the District Level*

To achieve the goal of making CS education truly accessible for all students requires school districts to undergo ambitious planning and institutional change. This research examined how leading school districts are addressing equity in their CS education efforts. Researchers conducted a study of eight school districts that developed comprehensive CS education initiatives to understand how different ideas about equity in CS education—from reaching all students, to creating inclusive classrooms, to teaching about equity issues in tech—make their way into district initiatives. The researchers identified challenges, promising approaches and emerging strategies from which other districts, policy-makers and the larger CSed community can learn.

(Grant No. 93661906)

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2018 awardees

Harvard University Graduate School of Education

Karen Brennan

How do K-12 Teachers Assess Creative Work in CS Classes?

Making CS accessible for all K-12 learners requires opportunities for young people to feel interested in and connected to computing. Creative programming activities foster interest and connection, but uncertainty about how to assess programming as creative work makes it difficult for K-12 teachers to incorporate creativity in the computing classroom. This one-year study investigated how CS teachers assessed the creative curriculum used to teach CS. This research informed teachers, instructional designers, and researchers about classroom-level decision-making and design.

(Grant No. 93661905)

Indiana University

Anne Leftwich

Examining the Impact of Socially Relevant Problem-based Learning Curriculum at the Elementary Level: Students' CS Interest/Knowledge and Teachers' Implementation Needs

This project piloted a 6th grade student-centered Problem-Based Learning (PBL) with social impact CS curriculum that investigated what support tools can be designed to decrease instances of bullying in schools. The researchers used a research practice partnership with local 6th grade teachers to improve their understanding of how PBL impacted students' CS interest and knowledge at the elementary level, and what supports teachers needed to facilitate PBL in the CS classroom.

(Grant No. 93661904)

University of Massachusetts Amherst

W. Richards Adrion

CSforAll in Springfield MA: An Elementary CS/CT Curriculum Integration Pilot

This pilot study integrated Massachusetts' Digital Learning and Computer Science standards with CS and computational thinking (CT) concepts, learning progressions, and practices in core curricula at the kindergarten and grade 3 levels in the highly diverse Springfield Public School (SPS) district in Massachusetts. The researchers created, assessed and revised 16-24 integrated CS/CT lessons in eight schools at each grade level. This project helped researchers better understand how to increase teacher knowledge and effectiveness for creating and teaching an integrated CS/CT K-5 curricula that reaches and engages diverse students.

(Grant No. 93661903)

University of Pennsylvania

Yasmin Kafai

MADE (Music ArtDesign with Etextiles)

This program introduced students in Career and Technical Education courses to more advanced computing concepts through electronic textile designs. Working together with Exploring Computer Science (ECS) high school teachers, the researchers collected evidence of student learning and teacher practices to address critical questions about student growth in their CS practices, knowledge, motivation, and future projections. This project provided curriculum prototypes for integrating arts into high school computing and helped researchers better understand student learning and teacher professional development in Career Technical Education courses.

(Grant No. 93661902)

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Awardees

University of Texas, Austin

Carol Fletcher

Project ROCS (Rural Opportunities in CS)

This project produced a framework for collecting and reporting outcome measures that accurately show access to and participation in K-12 CS education, especially for students in rural communities. This project developed viable solutions for measuring, scaling and sustaining equitable access to CS education within rural communities and other historically underserved populations.

(Grant No. 93661901)