2024 Annual Report

Educator Workforce Investment Grant in Computer Science External Evaluation

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Executive Summary

California's Educator Workforce Investment Grant in Computer Science (EWIG: CS) aimed to address a statewide need for educators—including teachers, paraeducators, school leaders, and counselors—who have the knowledge and skills to create high-quality learning opportunities for students in computer science. The American Institutes for Research® (AIR®) serves as the external evaluator for this grant and has developed this annual report to share findings from data collected in 2024. The report examines experiences and outcomes associated with two key components of the EWIG: CS program: (1) a collection of multiday workshops offered under the umbrella of Summer of CS and (2) efforts to promote professional learning in computer science by a network of county office of education administrators known as Computer Science Champions (or CS Champions).

Findings About Summer of CS 2024

A series of 44 workshops offered in summer 2024, known collectively as Summer of CS, sought to build the capacity of K–12 educators in California to deliver high-quality instruction in computer science. Registration data and pre- and post-workshop participant survey responses highlight several key findings about the workshop experience.

Key Finding #1: A total of 733 educators participated in a Summer of CS workshop in summer 2024, more than half of whom had no prior experience with teaching computer science. The gender and racial representation of these participants closely matched the overall California K–12 teacher workforce.

Key Finding #2: Survey respondents reported very positive experiences with Summer of CS workshop quality. For example, 98% of respondents agreed or strongly agreed that the workshop made them feel included in a community of computer science educators and advocates.

Key Finding #3: Survey responses reveal a positive and statistically significant change in confidence in teaching computer science between the beginning and the end of Summer of CS workshops; positive changes in confidence were more pronounced among survey respondents from historically underrepresented subgroups. These changes were largest for survey respondents who identify as women, belong to underrepresented racial groups, and who have no prior experience teaching computer science.

Key Finding #4: Survey responses reveal a positive and statistically significant change in beliefs about students who can and should do well in computer science. These changes were smaller in magnitude than those for educator confidence, but the pre-workshop values were also higher, suggesting that Summer of CS workshop participants already had strong beliefs about the importance of computer science and the ability of all students to succeed.

Findings About CS Champions

Members of the EWIG: CS planning team have recruited, onboarded, and provided ongoing trainings and supports for county office of education administrators to serve in the role of a CS Champion. CS Champions coordinate all aspects of grant-funded professional learning in computer science, and therefore provide a critical infrastructure for supporting computer science education. Two data sources, a set of focus groups conducted in summer 2024 and a survey administered in fall 2024, offer insights into the CS Champion experience.

Key Finding #5: CS Champions articulated a shared understanding of their role and perceived their activities as being pivotal to increasing teacher participation in computer science professional learning. Ninety percent of survey respondents strongly agreed or agreed that they understood their roles as CS Champions, and focus group participants' reflections aligned with the role definition articulated by members of the EWIG: CS planning team.

Key Finding #6: CS Champions rated the EWIG: CS grant as effective at addressing some of the most significant barriers to equitably expanding computer science education. The two barriers for which CS Champions indicated that EWIG: CS was most effective at addressing were insufficient (1) training or professional development for computer science educators and (2) funding. Among a list of barriers to computer science expansion that CS Champions ranked by significance in their survey responses, these were the third and fourth most significant barriers, respectively.

Key Finding #7: EWIG: CS has succeeded in creating a community of computer science education advocates and role models across California. Social network analyses reveal a robust community in which members are connected to multiple other CS Champions, and focus group responses describe the value of relationships among members of this network.

Evaluation Next Steps

Taken together, these data offer consistent promising evidence about the quality of EWIG: CS activities and supports. They speak to growth in capacity among California educators and the promise of this professional learning model. However, important aspects of the EWIG: CS story remain untold. Upcoming evaluation activities will aim to better understand changes in classroom behavior through a follow-up survey administered to Summer of CS participants in fall 2025. In addition, district case studies will explore changes in computer science course availability and participation over the life of the EWIG: CS grant. Meanwhile, further study is needed to better understand ways in which opportunities like those provided through EWIG: CS translate to improved learning experiences and outcomes for students.

Introduction

Digital technology shapes our lives in profound ways, as the tools employed in the workforce and our everyday lives increasingly rely on devices, hardware, and software that operate with efficiency that would have been unfathomable even a decade ago (Roser, 2023). Skills in computer science can often lead to lucrative career opportunities (Bureau of Labor Statistics, 2024; Carnevale et al., 2023; Strohl et al., 2024), but the ubiquity of technology in our everyday lives supports the idea that computer science education should not be for only a segment of our population but should be for all. Responsibly navigating a digital world requires everyone to understand the resources around us. The field of computer science, “the study of computers and all the phenomena surrounding them” (Newell et al., 1967), is more important than ever.

K–12 education represents fertile ground to build foundational skill sets and cultivate interest in further study and possible careers in computer science. Although opportunities to learn about computer science have unquestionably grown, they have not kept pace with the need (Code.org et al., 2024; Scott et al., 2019). The most recent data available in California show that only 39% of high schools offered computer science courses in 2016–17 and that only 3% of the state’s nearly 2 million high school students were enrolled in a computer science course during that year. Perhaps more importantly, those opportunities are not distributed equally. In 2017–18, only 30% of California students in Advanced Placement (AP) computer science courses were female, and just 497 Black and 76 Native American students took AP computer science courses (Scott et al., 2019). These disparities in access and participation may have roots that begin at an early age. A recent meta-analysis of gender stereotypes in science, technology, mathematics, and engineering found that, as early as age 6, 35% of 6-year-olds believed that boys were better at computing, compared to only 22% who believed that girls were better. This gap widens by age 18 (Miller et al., 2024).

Among the many root causes that contribute to these concerning outcomes, the state of California currently lacks the educator capacity to deliver high-quality computer science learning opportunities to all students in the state (Flapan, 2024). A statewide investment in in-service educator capacity building, initially launched in 2021 and expanded in 2023, is an opportunity to address this important obstacle to computer science teaching and learning. The lessons learned from this effort can help to inform future efforts to improve computer science education in California and across the country.

California’s EWIG: CS Investment

The state of California established the Educator Workforce Investment Grant program to provide professional learning opportunities for teachers, paraeducators, administrators, and counselors across the state. Two investments established through this grant program specifically aimed to promote high-quality computer science instruction and learning experiences aligned to the Computer Science Standards for California Public Schools.[1] The Budget Act of 2021 provided $5 million in initial funding to support activities between 2022 and 2024; a subsequent $15 million investment established through the Education Omnibus Budget Trailer Bill for the 2022–23 California State Budget provided resources to build on and expand the initial effort.

The Sacramento County Office of Education (SCOE), Californians Dedicated to Education Foundation (CDEF), San Bernardino County Superintendent of Schools (SBCSS), and University of California at Los Angeles (UCLA) serve as the lead agencies for the EWIG grants in computer science (EWIG: CS). Members of the project leadership team have designed their work according to the following theory of action: By offering a series of capacity-building opportunities to educators free of charge,[2] leaders in California's computer science education community can increase exposure to computer science among the state's educators; build educator knowledge, skills, and confidence to embed computer science into classroom practices at all grade levels; and increase the volume and quantity of computer science learning opportunities for students.

For the purposes of this report, two aspects of the EWIG: CS program are especially relevant. The first is a series of workshops, branded as Seasons of CS, designed to provide exposure to and build knowledge and skill in computer science education. These professional learning opportunities take the form of brief orientation workshops throughout the school year, multiday workshops during the summer, and follow-up academic year workshops for summer participants. Collectively, the workshops aim to build the capacity of teachers and administrators to offer high-quality computer science content through dedicated computer science courses and by integrating that content into existing academic courses.

A critical piece of infrastructure designed to support these learning opportunities is a statewide network of Computer Science Champions (or CS Champions) housed among the state's 58 county offices of education. These individuals are charged with designing and delivering the educator workshops and promoting and providing support for computer science education efforts in districts and schools. In a state that features more than 1,000 school districts and limited resources within the California Department of Education to support capacity building, this form of regional support creates an opportunity to serve educators across the state that is tailored to the particular strengths and challenges of the education systems within each county.

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[1] See https://www.cde.ca.gov/be/st/ss/documents/csstandards.pdf.

[2] Professional learning opportunities sponsored by EWIG: CS often also included a financial incentive for participants.

The AIR External Evaluation

The American Institutes for Research (AIR) has partnered with the EWIG: CS lead agencies to serve as the external evaluator for the grant. The evaluation, conducted under a subcontract to SCOE, operates as a required component of the overall EWIG: CS grant from the California Department of Education. To inform its evaluation approach, the AIR team organized a set of research questions around the four components of the Capacity, Access, Participation, and Experience (CAPE) Framework, which highlights *capacity* to deliver, *access* to, *participation* in, and *experiences* with computer science education.[3] The CAPE Framework directly addresses equity with each component and acknowledges the multiple layers of an educational approach required to equip students to thrive in computer science (Fletcher & Warner, 2021). Guided by this framework, the AIR evaluation seeks to address the research questions identified in Exhibit 1.

An evaluation of the 2021 grant, conducted by the Kapor Center, shared findings about the early stages of the EWIG: CS program. This report summarizes findings from data collection and analysis activities that took place in 2024. It addresses Research Questions 1 and 2 by examining participant experiences with the 2024 Summer of CS workshops. Results of pre-workshop and post-workshop surveys administered to workshop participants, as well as demographic and participation information collected from workshop registration data, provide insights into EWIG: CS efforts to improve computer science educator capacity. This report also explores Research Questions 3 and 4 by analyzing perspectives from CS Champions collected through focus group and survey responses.

Exhibit 1. EWIG: CS Evaluation Research Questions

Research Question	CAPE Dimension	Data Source
1. To what extent have EWIG professional learning activities reached and included their target audiences? – To what extent does the pool of participants reflect the California K–12 teaching force? – To what extent is participation in Seasons of CS orientation workshops associated with subsequent participation in other EWIG professional learning activities?	Capacity	Seasons of CS registration data

[3] See https://ecepalliance.org/resources/models/cape/.

Research Question	CAPE Dimension	Data Source
2. How do EWIG workshop participants describe the quality of their professional learning experiences? – What changes in knowledge and skills to teach CS do EWIG workshop participants report after their professional learning experiences? – What changes in beliefs and confidence to teach CS do EWIG workshop participants report after their professional learning experiences?	Capacity	Summer of CS participant survey
3. To what extent do CS Champions believe that the training and support they receive has adequately prepared them to carry out their work? What insights do CS Champions have about their role in equitably expanding CS education?	Capacity	CS Champion survey CS Champion focus groups
4. What is the nature and frequency of interactions among CS Champions outside formal professional learning activities?	Capacity	CS Champion survey CS Champion focus groups
5. To what extent have the numbers of discrete CS courses increased during the time period of the 2021 and 2023 EWIG grants?	Access	District case studies (forthcoming)
6. To what extent has participation in discrete CS courses increased during the time period of the 2021 and 2023 EWIG grants? To what extent has participation increased for historically underrepresented populations?	Participation	District case studies (forthcoming)
7. To what extent have teachers' instructional practices changed after participating in EWIG professional learning activities?	Experience	Summer of CS participant follow-up survey (forthcoming)

Methods

The findings in this report draw on four key data sources. To address Research Question 1, Seasons of CS registration data collected by SCOE enable a descriptive analysis of workshop participation. Pre-workshop and post-workshop surveys of Summer of CS participants inform analyses of Research Question 2, which explore workshop quality and changes in participant confidence and beliefs with respect to computer science. A second survey, this one administered to the full network of CS Champions, drives our examination of Research Questions 3 and 4 by collecting information about CS Champion experiences with their role and the relationships that exist among the CS Champions. Additionally, focus group data collected from a sample of CS Champions supplements these perspectives by providing more detailed information about roles, responsibilities, strengths, and challenges.

Seasons of CS Workshop Registration and Participation

SCOE administers a database in Airtable that tracks registration and participation for all Seasons of CS workshop participants. The database includes contact and basic demographic information for orientation workshop, summer workshop, and academic year workshop registrants. It also includes details about whether registrants have completed the required paperwork for participation and attendance data for each day of training. For orientation workshops, which are typically offered in a single session, participation is reflected by a single instance of attendance. For multiday Summer of CS workshops, the database captures attendance for each of the days during which the workshop takes place.

AIR researchers have access to this database and have used it to share information about Seasons of CS workshop participation (Research Question 1). For the purposes of this report, any registrant who attends at least 1 day of a workshop counts as a workshop participant.

Seasons of CS Workshop Participant Experiences: Survey

To generate findings about 2024 Summer of CS workshop experiences (Research Question 2), the AIR research team designed a survey in partnership with the EWIG: CS planning team and administered it to Summer of CS participants in summer 2024. Survey analyses explored perspectives on the workshop experience overall, as well as changes in responses from the beginning to the end of each workshop.

Survey Design

AIR researchers created the survey protocol in consultation with members of the EWIG: CS planning team from SCOE, CDEF, SBCSS, and UCLA. Most questions appeared in both a pre-workshop survey and a post-workshop survey. Survey items focused on key areas that EWIG: CS planning team members identified as important for the workshops, including participants' confidence in teaching computer science and their beliefs about what students can and should learn.

In addition, the post-workshop survey items asked respondents about the overall quality of their workshop experiences. Survey items asked respondents to provide responses to 5-point Likert scales ranging from Strongly Disagree to Strongly Agree. See Appendix A for a full list of survey items.

AIR's Institutional Review Board reviewed the survey and data collection procedures to ensure that the survey data collection met high standards for human subjects participation.

Survey Data Collection

AIR programmed and administered the pre- and post-workshop surveys using the online Verint survey platform. Using workshop registration and contact information provided by SCOE, AIR sent an email to all participants on the first and last days of their workshop with an individualized survey link. There is no comparison group for this survey that enables the research team to compare responses from workshop participants to those who did not engage in the same professional learning opportunity. Nevertheless, to ensure that participants' perspectives before and after their professional learning experiences aligned as closely as possible to the workshop experience itself—and not to other outside factors that could also influence their confidence or beliefs—each workshop provider reserved a window at the beginning of the first day for attendees to complete the pre-workshop survey and a window at the end of the last day for attendees to complete the post-workshop survey. After the conclusion of each workshop, AIR sent a follow-up email to nonrespondents requesting that they complete the survey.

Response Rates

Across all Summer of CS workshops, more than three quarters of the 733 attendees (569, or 78%) completed both surveys. In addition, 10% of attendees completed the pre-workshop survey only, and 8% of attendees completed the post-workshop survey only. Five percent of attendees did not complete either survey. See Appendix B for a more detailed analysis of survey response rates.

Survey Analysis

The AIR research team converted all Likert scale responses to numerical values ranging from 1 to 5, where *Strongly Disagree* = 1 and *Strongly Agree* = 5. By assigning each survey response a numerical value, we can then present the average change between the pre-workshop and post-workshop survey responses for each item. Analyses of change include only the respondents for whom we have both pre-workshop and post-workshop data; exhibits throughout this report include notes that list the number of respondents represented for each finding.

In addition, the research team conducted analyses to explore the relationship between respondent characteristics and the changes in self-reported confidence and beliefs. These analyses paid particular attention to aspects of participants' identities and professional history with computer science to explore the degree to which Summer of CS experiences might differ for respondents who have been historically underrepresented in the field. Using each measure of change as an outcome variable, analysts conducted multiple linear regression that included participant experience with teaching computer science, gender, and racial identity as independent variables. The team selected this model because the dependent variable was continuous, and we wished to explore the relationship of multiple predictor variables simultaneously with the change in responses between workshops. We assessed statistical significance at the $p < 0.05$ level. The text of this report highlights findings in which our regression models found the coefficients for any of these independent variables to be statistically significant. The research team conducted all survey analyses using the statistical software platform R.

CS Champion Experiences, Perspectives, and Network Interactions: Survey

AIR designed and administered a social network survey, focusing on CS Champion experiences in their role (Research Question 3) and the patterns of communication among members of the network (Research Question 4).

Survey Design

As with the Summer of CS participant survey, AIR collaborated with members of the EWIG: CS planning team from SCOE, CDEF, SBCSS, and UCLA to understand the topics that were most important with respect to the accomplishments and needs surrounding EWIG: CS and its future. Survey items focused on a variety of topics related to CS Champion relationships, responsibilities, and supports, as well as opportunities and barriers that might shape the future of computer science education in California.

Survey items took three basic forms:

- *Items About Interactions.* To better understand the nature of the CS Champions network and the relationships that exist among its members, an initial set of items asked respondents to identify other CS Champions with whom they had interactions outside the context of formal EWIG: CS activities and some of the details about those interactions.
- *Fixed-Response Items.* A second set of items asked participants to respond to fixed-response survey items about their experiences in their roles. Most of these items asked respondents

to provide responses to 5-point Likert scales ranging from Strongly Disagree to Strongly Agree; a question about barriers to progress in computer science education used a scale from 0 to 10 to rate the significance of different barriers.

- *Open-Ended Items.* Finally, a set of open-ended survey items enabled respondents to provide additional details or contextual information about their answers. See Appendix E for a full list of survey items.

As with the Seasons of CS survey, AIR's Institutional Review Board reviewed the survey and data collection procedures to ensure that the survey data collection met high standards for human subjects participation.

Survey Data Collection

Through consultation with the EWIG: CS planning team and regional leads for EWIG: CS activities, the research team identified a list of individuals in the CS Champion role. The composition of the group regularly evolves as people move in and out of positions in county offices of education. To ensure that respondents had sufficient experience in their roles to speak knowledgeably about them while capturing perspectives that were informed by the Summer of CS experience, we defined our sample as CS Champions who were active in their roles at any point during the window of June 2024 to August 2024. The AIR team collected survey data between October 2024 and December 2024 by sending individualized survey links via email to a final sample of 54 people. AIR staff encouraged participation in the survey through remarks at the monthly meetings of CS Champions in October and November 2024 and sent three email reminders to nonrespondents during the administration window. In addition, members of the EWIG: CS planning team engaged in individual outreach to nonrespondents to encourage their participation.

Response Rates

The CS Champions survey generated an overall response rate of 88%, as 48 of 54 eligible respondents provided answers to the survey.

Survey Analysis

The AIR team converted all Likert scales into numerical values and performed a social network analysis when assessing the topics communicated between CS Champions. This analysis included producing a sociogram and examining the proportion of communication ties that exist out of the ties that could have existed across a variety of different topics and the robustness of the overall communication network via its bi-component distribution. The research team conducted network inference via conditional uniform graph tests to examine if the various covariates (racial identity, gender identity, and years of experience) had an impact on a CS

Champion's position in the network. The research team conducted all survey analyses using the statistical software platform R.

Although five people did not take the survey, other CS Champions nevertheless reported interactions with those nonrespondents. For analysis purposes, the research team assumed that any reported interaction was reciprocated because communication can be viewed as an undirected interaction (i.e., There is no directionality in the interaction, including relations such as who we spend time with, who we talk with, and so forth. This contrasts with interactions that are characterized by directionality, such as who we like, who we give gifts to, and so forth.). The survey question asked individuals to indicate who they communicated with outside of the formal context of EWIG: CS-led activities designed for all social activities and prompted individuals to select from a fixed list of topics they discussed with that particular individual. Examples of these topics include state computer science standards, capacity building in computer science education, and quality professional learning standards. See Appendix E for the full survey item.

CS Champion Experiences and Perspectives: Focus Groups

To supplement survey findings about Research Questions 3 and 4, AIR conducted focus groups with a sample of CS Champions.

Focus Group Protocol Design

The AIR team developed the focus group protocol in consultation with the EWIG: CS leadership team and grounded the questions in Research Questions 3 and 4. Questions asked participants about their role as CS Champions and the greater CS Champion network, the extent to which CS Champions and their work contributed to equitably expanding CS education, and ways in which EWIG: CS training and supports facilitated their success. Focus group participants also shared insights about efforts to sustain their work and how the state can best promote CS education. The focus group protocol is available in Appendix F.

Focus Group Data Collection

The focus groups employed a non-probabilistic convenience sampling approach. The team of researchers at AIR conducted six focus groups with a total of 19 participants in summer 2024: three in-person focus group sessions conducted during Computer Science Professional Development Week (known as CSPDWeek) in Anaheim, California, and three virtual focus group sessions facilitated over Zoom. AIR researchers and members of the EWIG: CS leadership team collaborated to recruit participants through email outreach and an invitation to participate delivered during a monthly virtual meeting of CS Champions. In-person opportunities were available to the subset of CS Champions who attended CSPDWeek; the research team opened opportunities for virtual focus group participation to all CS Champions. In an attempt to ensure that the focus groups accurately represented the group of CS Champions, AIR researchers tracked the attendance of participants, mapping their region and role to include participants from all seven regions.

Focus Group Analysis

To analyze data, the AIR research team developed a codebook (see Appendix G) to highlight themes related to the study's research questions. This codebook was also aligned to the focus group protocol, allowing for easier coding of the transcripts. Two AIR researchers each coded the same focus group and met to compare their codes, examining similarities and differences between their coding and establishing understood norms. These two AIR researchers then coded six transcripts each, conducting a thematic analysis of the content that was said by focus group participants, as well as quantifying responses to focus group questions. The research team employed thematic analysis paired with quantitative counting of similar responses to determine not just what was said but also how often it was said in focus groups. After coding was complete, a third AIR researcher joined a meeting with the two researchers who coded the transcripts, and together they analyzed themes within each section and across the sections as a whole.

Limitations

Any research approach features limitations that should shape the reader's interpretation of study findings. Here we highlight important implications of the methods employed for the EWIG: CS evaluation.

Self-Reported Data

First, the findings presented here rely heavily on self-reported data. The Summer of CS workshop participant survey, CS Champions survey, and CS Champions focus groups all ask individuals who have been part of the EWIG: CS grant to share their perceptions and memories of their experiences. The resulting data are therefore subject to factors, such as recall bias and social desirability bias, that might shape their responses to survey and focus group questions.

Statements of Causal Inference

Second, the study design does not permit causal inferences about the impact of the EWIG: CS program. There is no comparison group that would enable us to analyze differences in outcomes reported by program participants to individuals who have not received the same opportunities as those provided by the grant. Summer of CS workshop participants completed a pre- and post-workshop survey, which enabled a comparison of perspectives within the same individual before and after a professional learning experience. Nevertheless, we are unable to claim that EWIG: CS *caused* the results we report here.

Additional Limitations

We also highlight additional details specific to the data collection approaches employed for this study.

Online surveys like those used to collect data from Summer of CS workshop participants and CS Champions provide several benefits. However, because the surveys use standardized language for all respondents, some respondents may interpret questions differently, and bounded response options may not fully capture the nuances of all interactions.

The nature of a focus group that uses a semi-structured data collection protocol can result in variation in data collected. The number of participants in a focus group, the conditions under which a focus group takes place (especially in-person versus virtual), and the backgrounds of focus group participants can all shape the conversation that takes place. For example, a participant in one focus group of more than four participants shared that they did not receive coaching from EWIG: CS activities and, in agreement, no other respondent in that same focus group spoke about coaching. However, in a smaller focus group, coaching became a main topic of conversation. However, because the number of participants speaking about coaching across focus groups was limited, coaching did not emerge as a major theme across EWIG: CS supports and trainings.

Finally, with respect to the social network analysis of CS Champions, the survey generated high response rates but nevertheless operated with missing data from the six survey nonrespondents. To appropriately aggregate the data, the research team coded the missing respondents as having reciprocated ties. That is, if Person A reported having a tie with Person B but Person B did not complete the survey, we analyzed the data as if Person B had also reported a tie with Person A. However, there are potential ties not captured through our analysis due to the incomplete complete network census of respondents reporting on their ties. For example, if Person B and Person C have ties to one another but neither completed their survey, our analysis will not capture that connection between two network members.

Findings About Summer of CS 2024 Workshop Participation

The professional learning opportunities promoted by EWIG: CS center around three types of workshops, all offered under the banner of Seasons of CS:

- **Orientation workshops** offered throughout the year aim to demystify computer science by giving a broad range of educators access to a content area that may otherwise have been intimidating, providing easy tools to integrate into their daily practice, and sparking interest in further learning.
- **Multiday workshops, branded as Summer of CS**, offer intense learning experiences that enable deep engagement with specific courses or topic areas related to computer science.
- **Academic year workshops** offer participants opportunities for continued engagement and problem solving regarding topics introduced during summer workshops.

Because of their duration and intensity, Summer of CS workshops stand out as the vehicles through which educators can engage most deeply in building their computer science knowledge and skills.

Key Finding #1

A total of 733 educators participated in a Summer of CS workshop in summer 2024, more than half of whom had no prior experience with teaching computer science.

The Summer of CS effort supported through the EWIG: CS grant featured 44 different workshops delivered during the course of 10 different weeks in a variety of locations in summer 2024. The flagship event among these offerings was CSPDWeek, a collection of 10 concurrent workshops conducted July 22–26 in Anaheim, California. In addition, 34 regional offerings enabled educators from around the state to participate in professional learning about computer science. Workshops, which included anywhere from four to 44 participants, ranged from 3 to 5 days in length. All workshops offer opportunities for ongoing engagement between facilitators and participants through follow-up workshops during the 2024–25 academic year.

Demographics of Workshop Participants

A total of 733 educators participated in one of the Summer of CS workshops in summer 2024.[4] Exhibit 2 displays the gender and racial identity of these educators, including a comparison to the overall California K–12 teaching workforce. Workshop participants were more likely to be women, be Asian/Filipino, and have two or more racial identities than the statewide teaching workforce.

Exhibit 2. Gender and Race of Summer of CS Participants and All California FTE Teachers

Category	Summer of CS Participants	California FTE Teachers 2022–23
Woman	77%	73%
Man	20%	27%
African American	2%	5%
American Indian or Alaska Native	1%	1%
Asian/Filipino	12%	8%
Hispanic or Latino	23%	25%
Pacific Islander	0%	0%
White	45%	56%
Two or More Racial Identities	15%	1%
Racial Identity Not Reported	2%	5%

Note. n = 733. Percentages may not add to 100% due to rounding. Three percent of Summer of CS participants listed "Non-Binary" or did not respond to a question about their gender identity. *Source for Summer of CS participant data*: SCOE registration records. *Source for California FTE teachers data*: Commission on Teacher Credentialing (2024).

Additional details about Summer of CS participants may also be instructive, even when comparable statewide data do not exist. The state's EWIG: CS investment recognizes the importance of fostering computer science learning opportunities at all grade levels, and regional workshops across the state served educators from all grade levels. In-person workshops offered as part of CSPDWeek targeted educators in Grades 9–12 specifically. Exhibit 3 demonstrates that nearly three in 10 educators identified themselves as being part of this target group. The exhibit also illustrates the range of prior experience with CS instruction

[4] Although educators could participate in multiple orientation workshops, EWIG: CS guidelines restricted each individual to participation in a single Summer of CS workshop. When originally released, this report listed the total number of participants as 736. This updated figure of 733 corrects a data quality issue in the registration data.

among workshop attendees; more than half of Summer of CS participants reported no prior experience with teaching computer science.

Exhibit 3. Teaching Assignments and Experience for Summer of CS Participants

Category	Summer of CS Participants
Grade Level: 9–12	29%
Grade Level: 6–8	40%
Grade Level: TK–5	46%
Years teaching computer science: 0	51%
Years teaching computer science: 1–2	22%
Years teaching computer science: 3–5	14%
Years teaching computer science: 6–9	6%
Years teaching computer science: 10 or more	7%

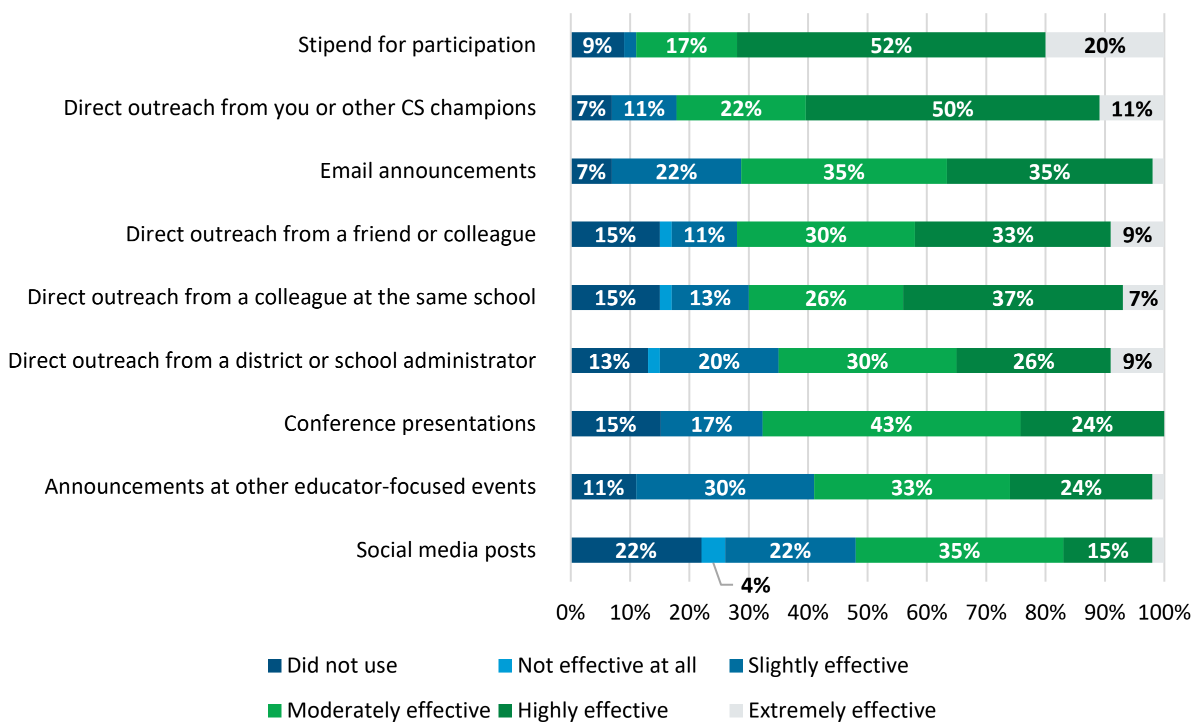
Note. n = 733. Percentages for grade level do not add to 100% because respondents can teach more than one grade level. S*ource:* SCOE registration records.

One important design feature of the EWIG: CS grant is a series of orientation workshops conducted throughout the 2023–24 school year designed to introduce educators to computer science content and spark their interest in learning more. Such workshops, if successful, could help to demystify the content area and decrease anxiety about engaging with computer science. They might also motivate educators to learn more about computer science through Summer of CS professional development offerings. Workshop enrollment data demonstrate that, of the 1,359 educators who participated in an orientation workshop in 2023–24, 147 (11%) attended the full Summer of CS workshop. Those 147 participants who attended both an orientation workshop and a Summer of CS workshop represent 20% of the total Summer of CS participants in 2024.

Approaches to Workshop Recruitment

CS Champion survey responses enable us to explore the gamut of approaches employed to recruit educators to attend Seasons of CS workshops. Exhibit 4 shows that CS Champions found the stipend for participation to be the most effective tool for encouraging participation, with nearly three quarters of respondents (72%) calling that approach extremely or highly effective. Other strategies that survey respondents perceived to be effective included direct outreach from CS Champions (61%), colleagues or friends (42%), or district or school administrators (35%) and email announcements (37%).

Exhibit 4. CS Champion Perceptions of Effectiveness for Selected Summer of CS Recruitment Approaches



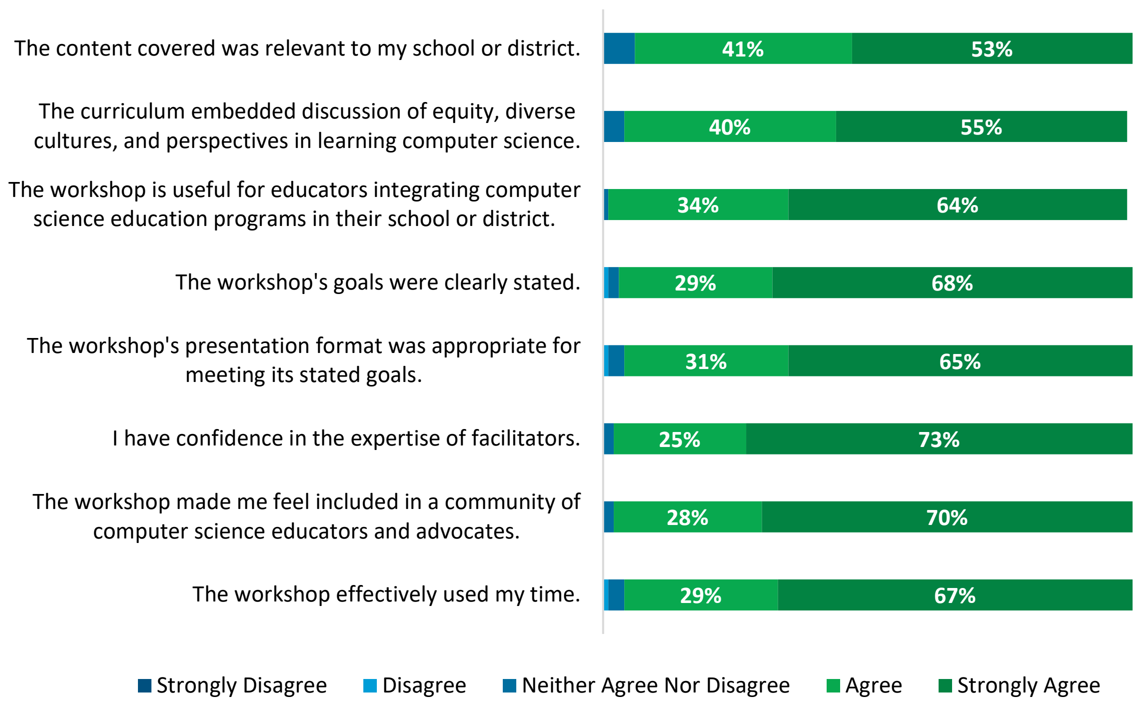
Note. n = 48. *Source:* CS Champions survey.

Findings About Summer of CS 2024 Overall Workshop Quality

Beyond overall participation levels, a key measure of success for Summer of CS is participants' perspectives about the quality of their workshop experiences. Exhibit 5 shows participant responses about workshop quality from the post-workshop survey. An overwhelming majority of respondents agreed or strongly agreed with statements that described the relevance, usefulness, and execution of their workshop. For example, 95% of respondents strongly agreed or agreed that the curriculum embedded discussion of equity, diverse cultures, and perspectives in learning computer science. Similarly, 98% of respondents strongly agreed or agreed that the workshop made them feel included in a community of computer science educators and advocates.

> **Key Finding #2**
>
> **Survey respondents reported very positive experiences with Summer of CS workshop quality.**

Exhibit 5. Participant Perceptions of Summer of CS Workshop Quality



Note. n = 626. *Source:* Summer of CS participant survey.

Findings About Summer of CS 2024 Changes in Workshop Participant Perspectives

Although it is instructive to learn about workshop attendees' perceptions of quality, a positive experience alone is insufficient for gauging success. An effective professional development effort supported by EWIG: CS should help participants grow their knowledge, understanding, and skills to effectively meet students' computer science learning needs. An analysis of survey responses enables us to describe ways in which self-reported beliefs and levels of confidence increased from the beginning to the end of the Summer of CS workshops. Please note that all of the differences reported regarding pre- and post-workshop changes are statistically significant at an alpha level of 0.05.

Survey results reveal positive and statistically significant change in confidence in teaching computer science between the beginning and the end of Summer of CS workshops; positive changes in confidence were more pronounced among survey respondents who are women, who have racial identities that are historically underrepresented in computer science, and who have less experience with teaching computer science. We also find a positive and statistically significant change in beliefs about students who can and should do well in computer science. Growth in responses to these survey items was smaller in magnitude than those for educator confidence. However, the pre-workshop values were also higher, which suggests that participants in Summer of CS workshops entered those workshops with strong beliefs about the importance of computer science and the ability of all students to succeed.

Changes in Participant Confidence: Overall Results

The first set of survey items addresses participant confidence. Among these responses, participants reported the highest level of change for the statement, "I am confident in my ability to teach in alignment with California's computer science standards." The difference of 1.04 indicates that respondents, on average, changed a full response option between the beginning and the end of the workshop. The average level of confidence grew for each of the items in Exhibit 6, with the magnitude of change ranging from 0.60 to 1.04. All changes in Exhibit 6 are statistically significant.

Exhibit 6. Changes in Summer of CS Participant Confidence With Respect to Computer Science

I am confident in my ability to . . .	Pre-workshop Mean	Post-workshop Mean	Mean Change
Teach computer science.	3.15	4.05	0.90
Articulate to administrators why computer science is important.	3.64	4.35	0.71
Articulate to students why computer science is important.	3.82	4.42	0.60
Answer student questions about computer science material.	3.07	3.97	0.90
Teach a stand-alone computer science class.	2.71	3.60	0.89
Incorporate computer science content into another subject area.	3.34	4.22	0.88
Teach in alignment with California computer science standards.	3.08	4.12	1.04
Assess students' learning and performance in computer science.	3.04	4.04	0.97

Note. n = 515. *Source:* Summer of CS participant survey. For the purpose of analysis, the research team assigned a numerical value to each response option (Strongly agree = 5, Agree = 4, Neither agree nor disagree = 3, Disagree = 2, Strongly disagree = 1). All changes are statistically significant at an alpha level of 0.05.

Changes in Participant Confidence: Subgroup Results

Just as efforts to support the equitable expansion of computer science seek to overcome historical trends of underrepresentation among students, so too do they aim to address the computer science teaching force. Computer science is a field primarily populated by men who identify as White or Asian (John & Carnoy, 2017; Zippia, 2023). Moreover, lack of preparatory privilege and confidence often create obstacles for people to pursue opportunities to learn and contribute to computer science education (Yadav et al., 2016). If EWIG: CS is to expand opportunities for historically underrepresented educators, it is important for the AIR evaluation to examine progress toward that goal by understanding the experiences of women, people of color, and educators who have not previously engaged with computer science.

Exhibit 7. Changes in Summer of CS Participant Confidence With Respect to Computer Science by Respondent Characteristic

I am confident in my ability to . . .	Pre-workshop to Post-workshop Mean Change					
	Women	Men	Under-represented Racial Group	White or Asian	CS Teaching Experience: 0 Years	CS Teaching Experience: 1+ Years
Teach computer science.	0.95	0.65	1.04	0.82	1.13	0.72
Articulate to administrators why computer science is important.	0.76	0.48	0.89	0.62	0.91	0.54
Articulate to students why computer science is important.	0.64	0.45	0.71	0.55	0.79	0.44
Answer student questions about computer science material.	0.97	0.57	1.07	0.82	1.22	0.66
Teach a stand-alone computer science class.	0.93	0.62	0.95	0.84	1.04	0.73
Incorporate computer science content into another subject area.	0.93	0.63	1.02	0.80	1.09	0.71
Teach in alignment with California computer science standards.	1.09	0.86	1.25	0.94	1.18	0.89
Assess students' learning and performance in computer science.	1.04	0.67	1.18	0.87	1.18	0.78

Note. n = 515. *Source.* Summer of CS participant survey. For the purpose of analysis, the research team assigned a numerical value to each response option (Strongly agree = 5, Agree = 4, Neither agree nor disagree = 3, Disagree = 2, Strongly disagree = 1). The underrepresented racial group includes any individual who identifies with a race other than White or Asian.

Exhibit 7 displays the changes in confidence from the beginning of the workshop to the end of the workshop by gender, race, and prior computer science teaching experience. For nearly all eight survey items, the average change for the historically underrepresented educator group—that is, women, members of an underrepresented racial group, and participants without any prior computer science teaching experience—exceeds that of their peers. Regression analyses reinforce these findings. Holding other participant background characteristics constant, the coefficients for gender, racial identity, and computer science teaching experience are statistically significant for most of the eight survey items, with these exceptions:

- There were no statistically significant differences based on racial identity for confidence in articulating to students why computer science is important or integrating computer science content into another content area. However, the changes for these items were higher for women and for respondents with lower levels of computer science teaching experience.

- There were no statistically significant differences based on gender identity or years of computer science teaching experience for confidence in teaching in alignment with California's computer science standards. However, the changes for this item were higher for respondents with racial identities that have been historically underrepresented in computer science.
- There were no statistically significant differences among any subgroups for confidence in teaching a standalone computer science class.

See Appendix C for the full regression output.

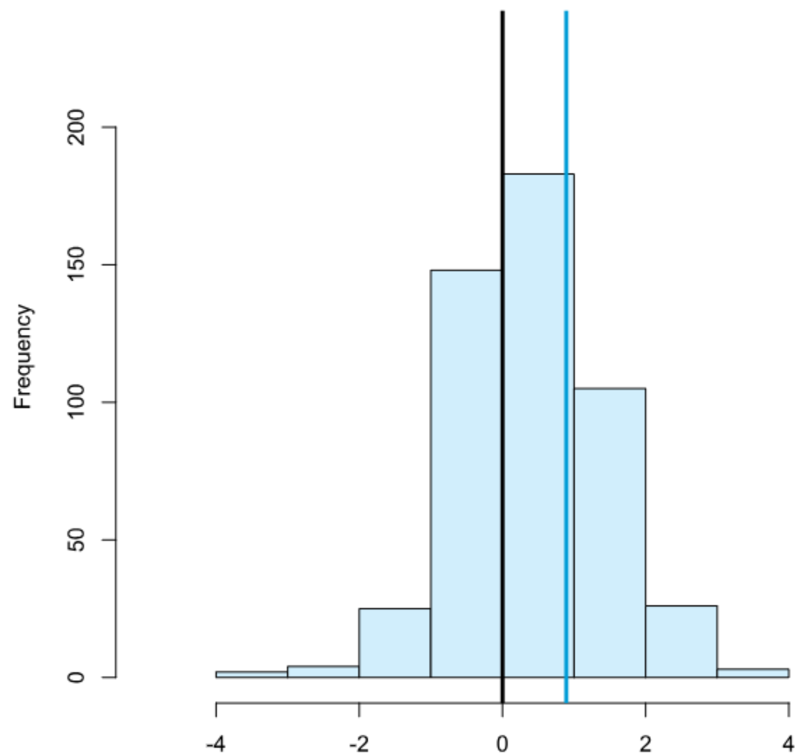
Key Finding #3

Survey responses reveal a positive and statistically significant change in confidence in teaching computer science between the beginning and the end of Summer of CS workshops; positive changes in confidence were more pronounced among survey respondents from historically underrepresented subgroups.

Changes in Participant Confidence: Variation in Results

The information presented in Exhibit 7 provides a useful overview of the *average* change reported by workshop participants, but it does not tell us much about the *variation* in change. In other words, it is important to understand not only what the typical change in confidence looks like, but how widespread a positive change is among participants, and how intense that change might be. To illustrate the range of experiences reported by survey respondents, the x axis of Exhibit 8 displays the number of points on the survey item Likert scale that a respondent's answer moved between the pre- and post-workshop surveys. If, for example, a respondent answered *Agree* to an item before the workshop and *Strongly Agree* to the same item after the workshop, the value of the change would be 1. If they answered *Neither Agree nor Disagree* before the workshop and *Strongly Disagree* after the workshop, the value would be -2. If they answered *Strongly Agree* before the workshop and *Strongly Agree* after the workshop, the value would be 0. The y axis of Exhibit 8 shows the number of respondents that fall into each category.

Exhibit 8. Changes in Summer of CS Participant Confidence to Teach Computer Science



The exhibit shows the changes in survey responses for the item, “I am confident in my ability to teach computer science.” The black vertical line is set at 0; 147 respondents reported no change from the beginning to the end of the workshop. The blue line represents the average change for this item; in this case, it matches the mean of 0.90 shown in Exhibit 5. This display demonstrates that the greatest number of respondents (183) reported an increase of 1 point on the Likert scale, and 105 respondents reported an increase of 2. Very small numbers of participants reported changes as high as 4 and as low as -4. Similar histograms for all pre- and post-workshop survey changes are available in Appendix D.

Changes in Participant Confidence With All Students and With Historically Underserved Students: Overall Results

A second set of items asked about participant confidence in recruitment, retention, and creating a sense of belonging for students. The survey began with three questions about respondents’ level of confidence for *all* students. Exhibit 9 shows that between the pre- and post-workshop survey, the average survey response increased by 0.71 points for the item, “I am confident in my ability to recruit more students to pursue computer science education.” All changes reported in the exhibit are statistically significant.

Exhibit 9. Changes in Summer of CS Participant Confidence with Respect to Serving All Students in Computer Science

Please indicate your level of disagreement or agreement with the following statements about ALL students in the school/organization where you work. I am confident in my ability to . . .	Pre-workshop Mean	Post-workshop Mean	Mean Change
Recruit more students to pursue computer science education.	3.55	4.26	0.71
Encourage students to continue pursuing computer science education.	3.72	4.36	0.64
Create a sense of belonging for students in computer science education.	3.85	4.43	0.58

Note. $n = 515$. For the purpose of analysis, the research team assigned a numerical value to each response option (Strongly agree = 5, Agree = 4, Neither agree nor disagree = 3, Disagree = 2, Strongly disagree = 1). All changes are statistically significant at an alpha level of 0.05.

The EWIG: CS grant seeks not only to expand computer science education opportunities overall, but to do so in a way that promotes equity and increases access for students who have not historically participated at high levels. To better understand ways in which Summer of CS might contribute to improving opportunities for students who are women/girls, who come from low-income backgrounds, who live in rural areas, who are English learners, and who identify as Black, Latino/a/e, and/or indigenous, the survey asked the same set of questions specifically about these students. Exhibit 10 shows that between the pre- and post-workshop survey, the average survey response increased by 0.60 points for the item, "I am confident in my ability to recruit more underrepresented students to pursue computer science education." All changes reported in Exhibit 10 are statistically significant.

Exhibit 10. Changes in Summer of CS Participant Confidence With Respect to Serving Historically Underrepresented Students in Computer Science

Please indicate your level of disagreement or agreement with the following statements about the historically underrepresented students in the school/organization where you work. I am confident in my ability to . . .	Pre-workshop Mean	Post-workshop Mean	Mean Change
Recruit more underrepresented students to pursue computer science education.	3.75	4.35	0.60
Encourage underrepresented students to continue pursuing computer science education.	3.83	4.41	0.58

Please indicate your level of disagreement or agreement with the following statements about the historically underrepresented students in the school/organization where you work. I am confident in my ability to . . .	Pre-workshop Mean	Post-workshop Mean	Mean Change
Create a sense of belonging for underrepresented students in computer science education.	3.90	4.45	0.55

Note. n = 515. For the purpose of analysis, the research team assigned a numerical value to each response option (Strongly agree = 5, Agree = 4, Neither agree nor disagree = 3, Disagree = 2, Strongly disagree = 1). All changes are statistically significant at an alpha level of 0.05.

Changes in Participant Confidence With All Students and With Historically Underserved Students: Subgroup Results

As with the first set of items about participant confidence, we examined differences among subgroups of participants through regression analyses that included racial identity, gender identity, and computer science teaching experience as independent variables.

Key Finding #4

Survey responses reveal a positive and statistically significant change in beliefs about students who can and should do well in computer science.

- Women had larger statistically significant changes in their confidence to create a sense of belonging for *all* students than their male peers, controlling for computer science teaching experience and race.
- Respondents with an underrepresented racial identity also had larger statistically significant changes in their confidence to create a sense of belonging for *all* students than their White and Asian peers, controlling for computer science teaching experience and gender.
- Respondents with an underrepresented racial identity also had larger statistically significant changes in their confidence to recruit *all* students and encourage *all* students to continue pursuing computer science education, controlling for computer science teaching experience and gender.
- Women had larger statistically significant changes in their confidence to recruit more *underrepresented* students to pursue computer science education, controlling for race and computer science teaching experience.

See Appendix C for the full regression output.

Changes in Participant Beliefs: Overall Results

Another dimension of equity in computer science concerns educator beliefs. Research suggests that conscious and unconscious bias shape views among adults and students about who can be successful in computer science (Ashcraft et al., 2017; Margolis, 2008; Scott et al., 2019). Success in an equity-focused effort to build capacity, therefore, might improve educator beliefs about who belongs in computer science and who can benefit from computer science. The next set of survey items, displayed in Exhibit 11, examines changes in respondents' attitudes about their students between the pre- and post-workshop surveys. For example, the average change was 0.20 for the item, "All students can do well on computing tasks with the right teaching and supports." All of these changes are positive and statistically significant.

Note that all of the changes presented in Exhibit 11 are smaller in magnitude than the items asking about changes in educator confidence (see Exhibit 5). However, the pre-workshop average response is also higher; each exceeds 4, which places those responses between *Agree* and *Strongly Agree* on the Likert scale. Thus, respondents had less room to grow in their responses between the beginning and end of the workshop. These data suggest that survey respondents entered their workshop already having high levels of belief about what students can and should be able to do in computer science.

Exhibit 11. Changes in Summer of CS Participant Beliefs About Computer Science

Please indicate your level of disagreement or agreement with the following statements.	Pre-workshop Mean	Post-workshop Mean	Mean Change
All students should learn the fundamentals of computer science.	4.43	4.63	0.20
All students can master the skills taught in computer science.	4.27	4.48	0.21
Learning computer science will help students succeed later in life.	4.43	4.60	0.17
All students can do well on computing tasks with the right teaching and supports.	4.39	4.59	0.20
All students can understand concepts underlying computer processes.	4.24	4.52	0.28

Note. n = 515. *Source.* Summer of CS participant survey. For the purpose of analysis, the research team assigned a numerical value to each response option (Strongly agree = 5, Agree = 4, Neither agree nor disagree = 3, Disagree = 2, Strongly disagree = 1). All changes are statistically significant at an alpha level of 0.05.

Changes in Participant Beliefs: Subgroup Results

As with previous items, we conducted regression analyses to examine the connection between participant characteristics and changes in beliefs. None of the differences among subgroups were statistically significant.

Findings About the CS Champion Experience

The workshops made available through the EWIG: CS grant are possible because of an infrastructure that is also supported by the state's computer science investment. Throughout the life of the grant, members of the planning team have recruited, onboarded, and provided ongoing trainings and supports for county office of education administrators to serve in a role they called CS Champions. These individuals coordinate and deliver Seasons of CS workshops themselves and also serve as a general source of support and expertise for computer science education for the regions in which they work.[5] This role is especially important, given the limited capacity that often exists within districts and schools and the limited capacity for building a computer science education field at the state level. The following findings highlight CS Champion insights about their roles.

CS Champions expressed a clear understanding of their role and believed it to effectively contribute to increased teacher participation in computer science professional learning. They also shared positive impressions of the trainings and supports available to them through the EWIG: CS grant. Survey and focus group data also highlighted the dynamics that shape the effectiveness of efforts to expand computer science education. Important barriers included competing priorities in K–12 education, educator capacity limitations, and funding, yet survey respondents also highlighted the effectiveness of EWIG: CS at addressing professional learning and funding needs. Survey respondents also expressed optimism about the sustainability of their efforts after the EWIG: CS grant ends, yet lingering concerns about funding and the structure of county offices of education warrant attention in preparing for the path forward.

The CS Champion Role

A role description developed by the EWIG: CS leadership team includes the following expectation for CS Champions supported through the grant: "Become an expert in at least one curriculum/grade span and build the capacity to support a relevant workshop for educators regionally and/or across California. Further, offer support of other efforts including contracted providers in offering sessions across grade bands to match local needs." The description goes on to identify five specific responsibilities for CS Champions:

1. Become familiar with grant objectives, goals, and parameters for expenditures.
2. Participate in monthly EWIG: CS COE Champion Forum Meetings.
3. Conduct ongoing district and community outreach and recruitment.

[5] For a full list of the 58 California county offices of education by region, as defined by the EWIG: CS grant, see Appendix H.

4. Coordinate regional and statewide CS workshops for K–12 teachers, paraeducators, counselors, and administrators.
5. Provide ongoing professional learning support.[6]

CS Champions' Understanding of Their Role

Through survey responses and focus group discussions, CS Champions articulated a shared understanding of their role and responsibilities that aligned with the description detailed above. The vast majority of respondents (90%) strongly agreed or agreed that they understood their role as a CS Champion (see Exhibit 12).

Focus group participants expressed a consistent vision of the CS Champion role as one that aligned with the foregoing description but often spoke to the bigger picture goals of the EWIG: CS program rather than the specific details that the program entails. Specifically, respondents noted that their responsibilities required them to connect with and know relevant computer science staff and experts, share computer science resources and activities, and advocate for the equitable expansion of computer science education in the state. At the end of one focus group session, participants collectively shared the following definition:

> **Key Finding #5**
>
> **CS Champions articulated a shared understanding of their role and perceived their activities as being pivotal to increasing teacher participation in computer science professional learning.**

> "CS Champions serve as liaisons from grant leads to educators and collaborative implementers of CS programs to provide high-quality professional learning for all educators to broaden participation in CS so that all students experience equitable and inclusive CS education."

Roughly half of focus group participants (*n* = 9) shared that their role as a CS Champion included acting as knowledge broker and relationship facilitator; respondents used terms such as "liaison," "point of contact," and "connector" of computer science experts, resources, and professional learning to describe this responsibility. One participant explained that, as a CS Champion, they were the "connective tissue" that brought relevant computer science information from the state to their region and county.

Seven participants explained that a key component of the CS Champion role included advocating for computer science education to be equitable and accessible for all students. Of those seven, three participants spoke specifically to strengthening educators' computer science content knowledge so that they are confident in providing computer science instruction. This

[6] COE CS Champion Roles and Workshop Checklist

responsibility often calls on CS Champions, in the words of one respondent, to "demystify what CS is," which often involves the understanding that the knowledge and skills associated with computer science extend beyond the ability to code and that careers in computer science often exist in fields outside of information technology.

Smaller numbers of respondents spoke to the specific expectations laid out in the official role definition. Six participants shared that CS Champions were responsible for EWIG: CS activities such as participating in monthly meetings and organizing and delivering professional learning sessions and that they were expected to share activities and updates with their county and/or region. For the CS Champion role, activities such as facilitating professional development or a workshop session, providing individual coaching, and sharing resources with teachers were examples of this professional learning responsibility. These reflections speak to a broader capacity-building role that CS Champions play in disseminating information and strengthening the community of computer science educators at the state, regional, and county levels.

CS Champions' Perceptions of Their Influence

CS Champions perceive their activities as being pivotal to increasing teacher participation in computer science professional learning. One of the most consistent perspectives across focus groups was a feeling of accomplishment in expanding teacher engagement in computer science learning opportunities. Thirteen of 19 focus group participants expressed their belief that their contribution to and connection with the CS Champions network contributed to increased teacher engagement with computer science learning opportunities. Several participants described an increase in teacher participation in workshops and training sessions offered at the county, regional, and state levels, noting an emphasis on teacher recruitment into computer science education.

> "We had monthly [professional learning] sessions, and we had people coming back month after month after month after month, and just eating it up and going, 'When's the next one? When's the next one?' And knowing that we did a really good job of getting them excited and wanting more. I mean, when a teacher wants to continue learning, then I think you've done a pretty good job."
>
> *– CS Champion Focus Group Participant*

Participants identified some of the characteristics that made these events successful. For example, seven focus group participants identified the recruitment of elementary school teachers and their exposure to computer science education as one of their greatest achievements. Although stand-alone computer science classes are common at the secondary level, the Computer Science Standards for California Public Schools (California Department of Education, 2018) emphasize learning opportunities for students in all grade levels. Such efforts aim to promote student interest at younger ages while also encouraging the integration of computer science content and practices into other academic disciplines. Participants explained that workshops and trainings geared toward the implementation of computer science education in elementary schools drew in a large pool of elementary educators. One participant described a training that included K–5 teachers engaging in computer science standards and practices with considerations for implementing computer science education for English learners at the elementary level.

In addition, opportunities to collaborate contributed to the perceived successes of professional learning supports: Three CS Champion participants shared that their greatest accomplishment within the network was collaborating with other CS Champions to develop joint professional development sessions. In a growing field often characterized by educator isolation, a network of leaders in computer science can provide an opportunity for critical collaboration in counties and regions that would otherwise not be in touch.[7] Another participant referred to accessibility, noting that workshops in 2023–24 were available in more “centralized” locations, which allowed educators from more rural or isolated communities to meaningfully participate in professional learning and engage with other educators, computer science experts, and learning advocates in ways they had not previously.

Trainings and Supports for CS Champions

Members of the EWIG: CS planning team described multiple activities and resources designed to build the capacity of CS Champions. Monthly calls that bring together CS Champions across the state typically feature opportunities for leadership development. Examples of topics for this leadership development have included doing a deep dive into the Computer Science Teachers Association Coaching Toolkit and learning about the importance of representation and inclusion in computer science. In addition, several resources aim to provide CS Champions with the logistical details and ongoing supports needed to plan and lead Seasons of CS workshops. Among these resources are an annual facilitator training, access to information about stipends and participation requirements on a project Wiki and the Seasons of CS website, and ongoing communication between the CS Champions and an assigned leader for their region. In some cases, CS Champions also joined Seasons of CS workshops as participants themselves to expand their subject knowledge and observe models of professional learning in computer science.

The following sections describe CS Champion perspectives on these supports and other resources that inform them in fulfilling the responsibilities of their roles.

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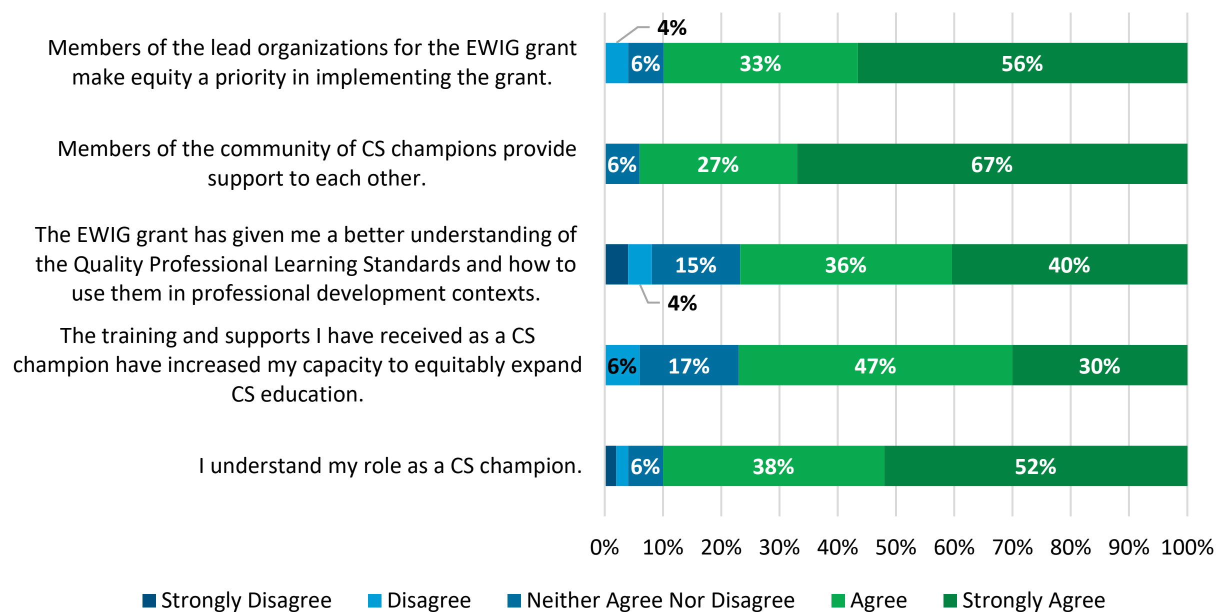
[7] For literature that explores the motivations and potential benefits of networks among computer science educators, see examples such as Cutts et al., 2017; Flapan et al., 2021; and Yadav et al., 2016.

Capacity-Building Efforts Available Through the EWIG: CS Grant

Although many survey and focus group findings speak to the quality of capacity-building efforts received by CS Champions, some focus group responses point to the possible need to improve CS Champions' understanding of certain elements of the grant, such as the trainings offered through their participation in EWIG: CS.

Overall, survey responses reveal positive impressions about the quality of supports received. For example, Exhibit 12 shows that 76% of CS Champions who responded to the survey strongly agreed or agreed that the EWIG: CS grant had given them a better understanding of the Quality Professional Learning Standards[8] and how to use them in professional contexts. Similarly, 77% of respondents strongly agreed or agreed that the training and supports they received had increased their capacity to equitably expand computer science education. With respect to the full group of CS Champions, 94% of respondents strongly agreed or agreed that members of the community of CS Champions provide support to one another. The next section of the report, Findings About the Network of CS Champions network, explores these issues in greater detail.

Exhibit 12. CS Champion Perspectives About Their Role and Supports Received



Note. n = 48. *Source:* CS Champion survey.

[8] The California Department of Education has developed a set of Quality Professional Learning Standards that "identify characteristics of professional learning that are most likely to support educators in building individual and collective capacity to meet professional, school, and student performance expectations." For more information, see https://www.cde.ca.gov/ci/pl/qpls.asp.

The survey also gave respondents the opportunity to write in a statement about the resources, supports, and/or strategies they received through EWIG: CS that will support them in equitably expanding computer science education. CS Champions most commonly identified community (*n* = 14) and professional development received through EWIG: CS (*n* = 9). Funding (*n* = 5) and receiving access to resources (*n* = 3) also appeared multiple times in these written responses, albeit with less frequency.

Nevertheless, when focus group participants were asked the question "Can you describe the trainings and supports you have received as a CS Champion?" some participants were able to identify and describe their training, whereas other participants either could not describe the training or struggled to articulate how they had been trained. The spectrum of responses may be a result of different interpretations of what is meant by the word "training." Because EWIG: CS facilitators embed these trainings in the context of other activities that take place during the monthly calls, those opportunities might also be less obvious to the CS Champion participants. Focus group responses could also be a reflection of the consistency or fidelity of the training experiences themselves. Further exploration is warranted to better understand these perspectives.

Although focus groups featured variation in the ability of CS Champions to identify training that they received in their roles, participants who did describe trainings most frequently identified a focus on instructional coaching in their responses; some CS Champions even recommended that coaching could be a potential solution to equitably expanding CS education. However, praise for the training about coaching was not universal. One focus group participant noted, "I had a slightly different experience. I often grappled with the connection between those particular coaching conversations directly to CS and the professional learning grant that we were delivering."

"For the first hour, we have two representatives from UCLA, and they come in and they have a focus around coaching and give some practical examples of what it looks like. They engage us with some live examples of it. So they'll actually model whatever strategy that they are discussing for that day. And they ask for feedback from us around our thoughts and where we're seeing that in our work, maybe where we're not seeing that in our work."

– CS Champion Focus Group Participant

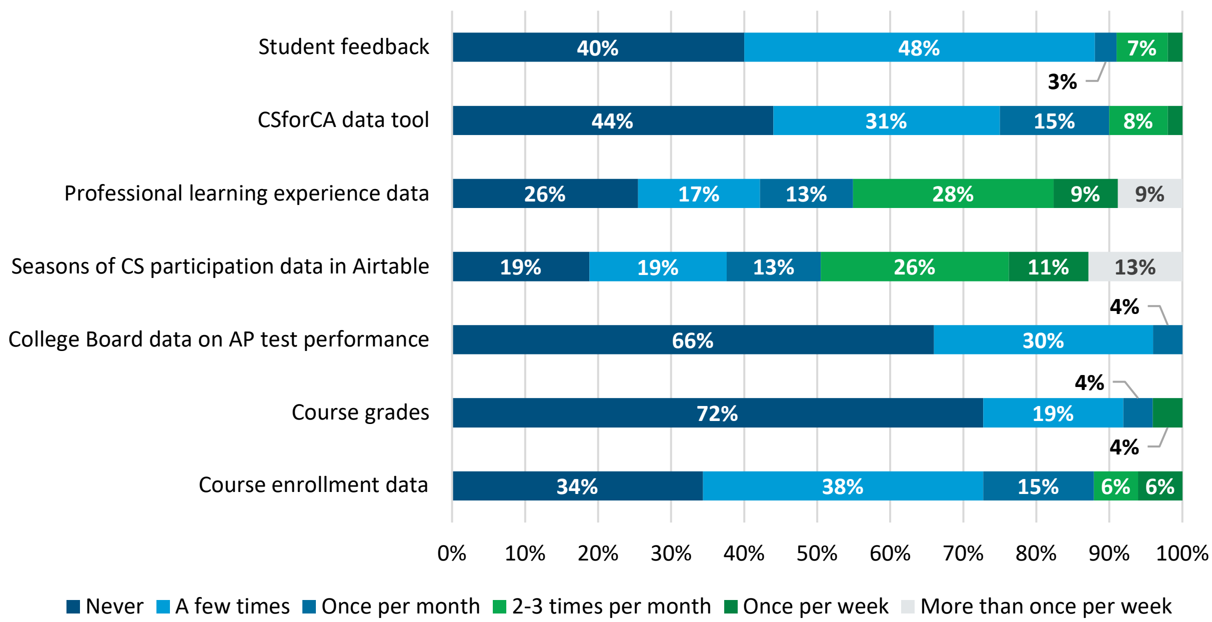
"I have not received trainings as a CS Champion. I have met with our regional people, and if I ever need any help or I'm confused or whatnot, I reach out to them. But in terms of training, it was just kind of laid out that 'here's what we do and here's your potential role, which is the disseminator of information.'"

– CS Champion Focus Group Participant

Data Sources That Inform the Work of CS Champions

Data about computer science learning opportunities, computer science participation, educator preparedness, and student learning outcomes can be vital sources of information for CS Champions to identify strengths in their counties, highlight areas of need, and design supports to effectively target and address those needs. Survey responses point to the range of data sources from which CS Champions draw as they conduct their work. The data most frequently used by CS Champions were those related to professional learning: Half of survey respondents (50%) indicated they used Seasons of CS participation data at least two or three times per month, and nearly half of respondents (46%) reported they used professional learning experience data at least two to three times per month. In contrast, nearly three quarters of respondents reported they never look at course grades, and roughly two thirds of respondents reported they never access data on AP test performance (see Exhibit 13).

Exhibit 13. CS Champion Frequency of Data Use, by Data Source



Note. n = 48. *Source:* CS Champion survey.

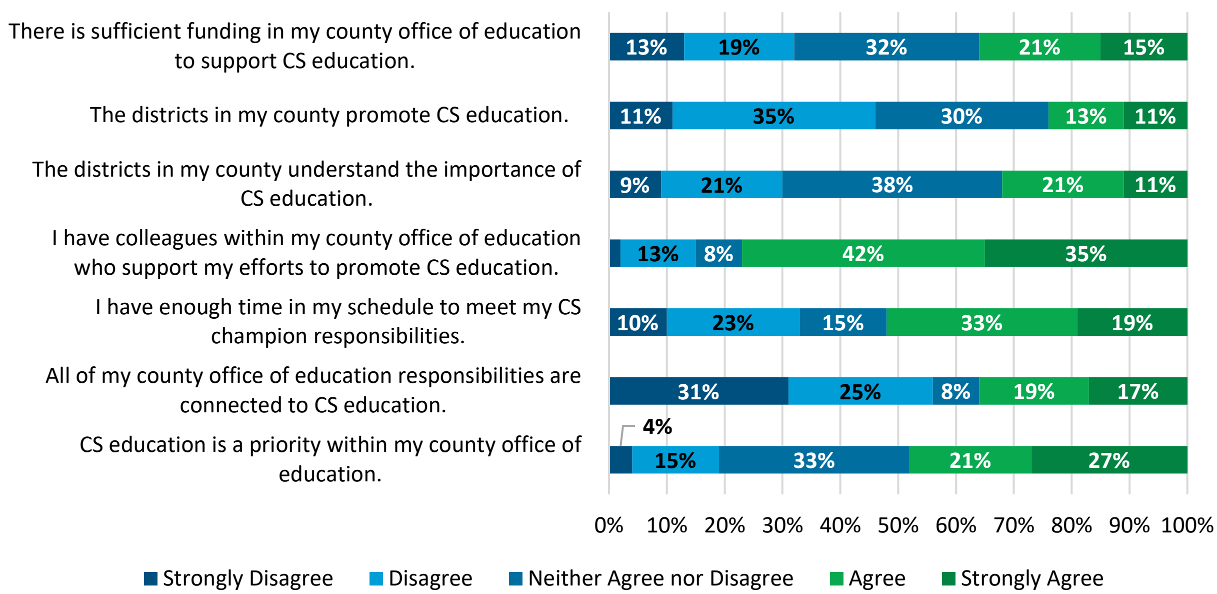
Capacity-Building Efforts Available Through the County Office of Education Structure

California's 58 county offices of education offer a structure for providing targeted support to districts and schools on a regional basis that might not otherwise be possible from a centralized state agency. However, these offices also operate according to their own priorities and funding environments. CS Champion survey items sought to better understand the degree to which county offices of education are well positioned to provide important capacity-building opportunities in computer science.

More than three quarters of respondents (77%) strongly agreed or agreed that they have colleagues within their county office of education who support their efforts to promote computer science education, and more than half of respondents (52%) strongly agreed or agreed that they have enough time in their schedule to meet their CS Champion responsibilities (see Exhibit 14).

However, survey responses displayed in Exhibit 14 also highlight concerns about the ongoing support available for computer science through the county office of education structure. Fifty-six percent of respondents strongly disagreed or disagreed that all their county office of education responsibilities are connected to computer science education, a reflection of the multiple hats that administrators often must wear. Moreover, little more than a third of respondents (36%) strongly agreed or agreed that there is sufficient funding in their county office of education to support computer science education. Slightly fewer than half of respondents (48%) strongly agreed or agreed that computer science education is a priority within their county office of education.

Exhibit 14. CS Champion Perspectives About County Office of Education Structure and Roles



Note. n = 48. *Source:* CS Champion survey.

Barriers to Progress

Despite the successes outlined in the previous sections, dynamics associated with the CS Champion role sometimes stand in the way of meeting its goals. For example, providing additional insights into the survey findings, five focus group participants suggested that the nature of county offices created challenges in their role as CS Champions. Three of those five participants shared how roles and responsibilities within a county office of education change frequently to respond to internal priorities and external funding streams. The shifting landscape and ambiguity of roles often results in confusion and frustration. It can also mean limited agency for individuals within their county office of education structure: One participant relayed that, due to the nature of their organization, they were "volun-told" to take up the CS Champion position. Another participant shared how an organizational policy made it difficult to contact other stakeholders, and a third participant spoke to ways in which the independent leadership structures across the state's 58 county offices contribute to misalignment in management, leadership, and processes.

> "We need funding, but we also need time, and giant influxes of funding don't necessarily solve the problem . . . And so training someone from within or finding someone that's doing something in the classroom and creating that pathway and building the system is taking longer. The funding is one part, but we also need the time and to have reliable funding."
>
> *– CS Champion Focus Group Participant*

Beyond challenges associated with the county office of education system, CS Champions rated the significance of various barriers to progress on a scale from 0 to 10. Based on earlier EWIG: CS data collection from the Kapor Center and discussion with the EWIG: CS planning team, the AIR research team identified nine obstacles that stand in the way of computer science education. Among the options provided in the survey, CS Champions selected two of the three biggest challenges as issues related to educator capacity: The availability of qualified computer science educators emerged as the largest challenge, with training or professional development for computer science educators ranking third (see Exhibit 15). Survey respondents ranked competing priorities as the second most significant barrier, followed by funding at fourth and administrator or counselor buy-in and support at fifth.

Exhibit 15. Barriers to CS Education to Equitably Expanding Computer Science Education in California, on a Scale of 0 to 10

Barrier	Average Response	Standard Deviation
Availability of qualified CS educators	8.54	1.76
Competing priorities and initiatives	8.21	2.61
Training or professional development for CS educators	7.62	2.36
Funding	7.52	1.98
Administrator or counselor buy-in and support	7.48	2.51
CS education policies	6.52	3.00
Discrimination or bias related to student background or identity	5.90	2.94
Availability of instructional materials	5.33	2.50
Social familial influence	5.21	2.75
Access to devices and connectivity	4.90	2.72
Student interest in CS education	4.52	2.49

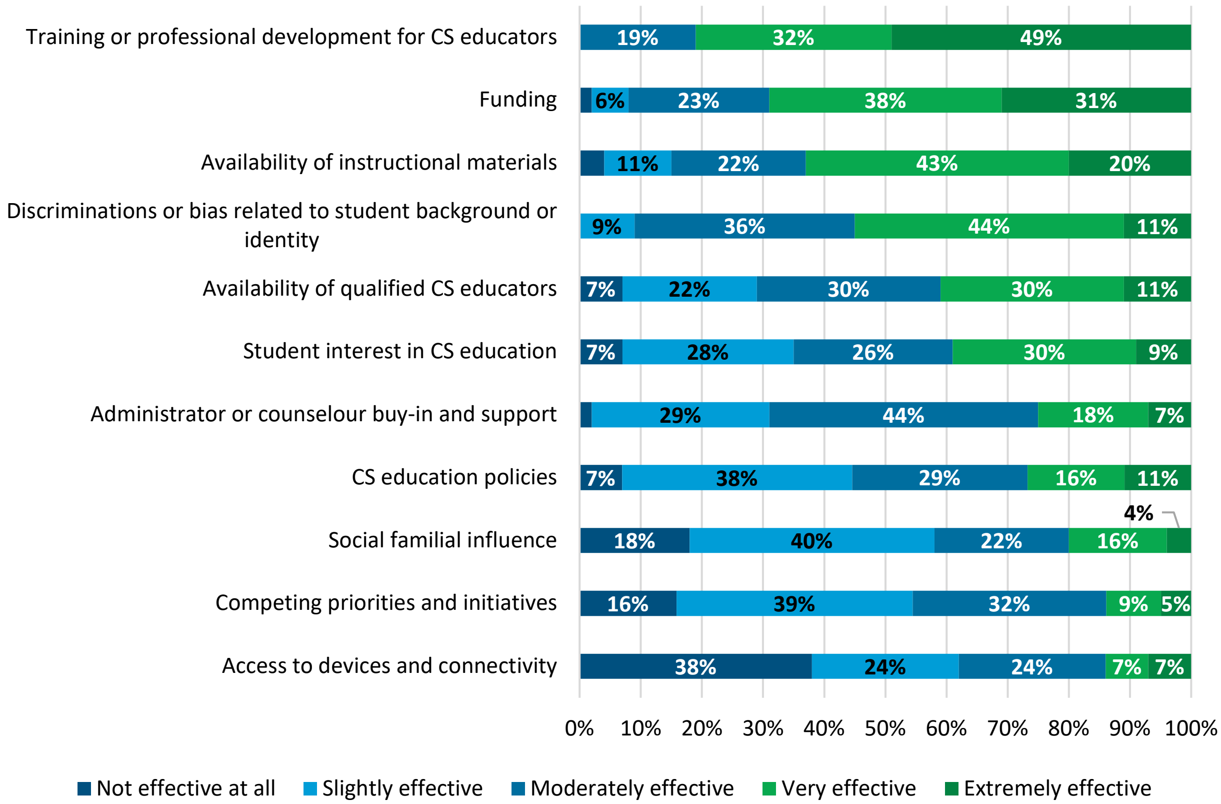
Note: n = 48. *Source:* CS Champion survey.

Key Finding #6

CS Champions rated the EWIG: CS grant as effective at addressing some of the most significant barriers to equitably expanding computer science education.

Respondents also rated how effective the EWIG: CS grant was in helping them address those barriers to progress on a scale from 1 (not effective) to 5 (very effective). Exhibit 16 demonstrates that the barrier for which CS Champions reported that the grant was most helpful was training or professional development of computer science educators; 81% of respondents rated it as extremely effective or very effective. This is perhaps unsurprising, given that the primary activities funded through the grant have been workshops designed to build educator capacity. Funding emerged as the second topic for which survey respondents reported that EWIG: CS was most helpful; 69% of respondents called it extremely effective or very effective. Again, given the multimillion-dollar investment to support educators in designing, facilitating, and participating in professional learning, this response aligns with the purpose and use of state grant funding.

Exhibit 16. Effectiveness of the EWIG: CS Grant at Addressing Barriers to CS Education to Equitably Expanding Computer Science Education in California, on a Scale of 1 to 5



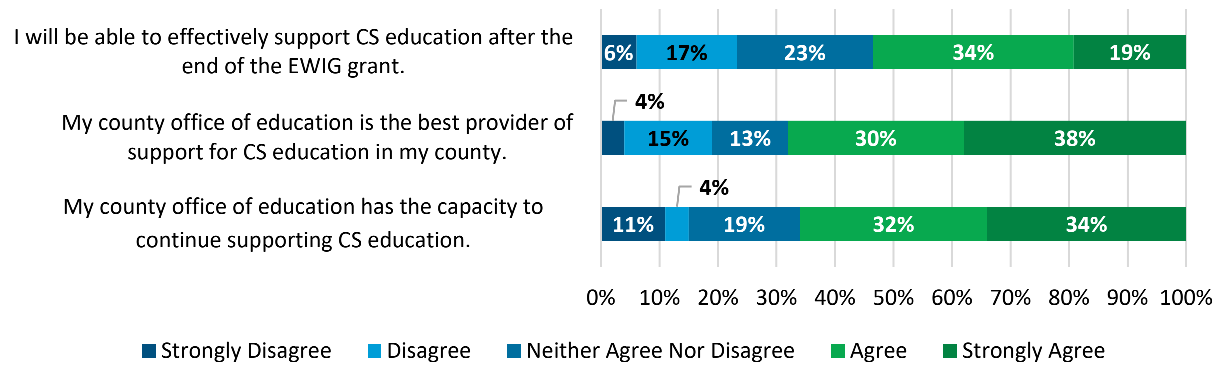
Note. n = 48. *Source:* CS Champion survey.

Sustainability of the CS Champion Role

The EWIG: CS grant is a finite and short-term funding stream, and there is no indication that upcoming iterations of the state budget will reinvest in the activities that it supports. The CS Champion roles themselves, for example, which use grant funding to support percentages of individuals' time, may need to operate with different resources if they are to continue. Sustainability is therefore a key issue that will shape the approach to supporting computer science education once the grant expires.

The survey asked CS Champions about their ability to continue their work after the EWIG: CS grant ends by requesting respondents' levels of agreement with three statements. The responses reveal some level of optimism about the future. Roughly two thirds of respondents strongly agreed or agreed that their county office of education has the capacity to continue supporting computer science education. In addition, more than half of CS Champions who took the survey (54%) strongly agreed or agreed that they will be able to effectively support computer science education after the end of the EWIG: CS grant (see Exhibit 17).

Exhibit 17. Sustainability of Supports for Computer Science Education



Note. n = 48. *Source:* CS Champion survey.

When prompted to write in what resources, supports, or strategies are needed to continue efforts to promote computer science education after the EWIG: CS grant ends, CS Champions generated a wide range of responses. The most common theme in these responses echoed respondent reflections about barriers in Exhibit 15; 8 respondents identified funding as critical for sustainability. Other responses included community (n = 6), continued communication (n = 5), and continued training (n = 2).

Findings About the Network of CS Champions

The relationship between CS Champions and educators in districts and schools is a vital indicator of the successes and challenges associated with EWIG: CS implementation. Anecdotal accounts from leaders associated with the grant have also underscored the value of the CS Champions network as an outcome in its own right. Computer science education remains a nascent field in K–12 public education, and the small size of many programs and limited resources to support them mean that educators often operate in isolation from one another (Code.org et al., 2024). A network that enables colleagues across organizational lines to share knowledge and resources, coordinate improvement efforts, and find emotional support from one another can help to improve the quality of CS education efforts and promote the sustainability of programs and services (Cutts et al., 2017). To that end, it is important to understand the nature of the relationships among CS Champions as an indicator of EWIG: CS progress.

> **Key Finding #7**
>
> **EWIG: CS has succeeded in creating a community of computer science education advocates and role models across California.**

Social network analysis and focus group responses suggest that EWIG: CS has fostered a robust community of advocates and leaders who can guide and support the equitable expansion of computer science education in California schools. Connections are strong both within and across regions, suggesting that, even in a large and diverse state, EWIG: CS brings members of the computer science education community across geographic contexts. Interactions among network members are most common around EWIG: CS activities and capacity-building efforts. In contrast, CS Champions reported that, among a range of topics, discussions were least common around funding.

Connections Among CS Champions

Focus group participants described a statewide network of CS Champions that features both formal and informal interactions. Focus group responses suggest that one key outcome of the EWIG: CS grant has been the cultivation of a network of county-level administrators committed to promoting and supporting computer science education across the state. In some cases, that network enables individuals to connect across multiple programs and funding streams. For example, four focus group participants described how they interacted with other CS Champions outside of official EWIG: CS activities due to their association and responsibilities with other related CS grants in the state of California, such as CS for NorCal, the CS Supplemental Authorization grant, and a Math, Science, Computer Science (MSCS) grant. Focus group participants described these opportunities to collaborate with computer science education activities that often “bleed into” those outlined in EWIG: CS.

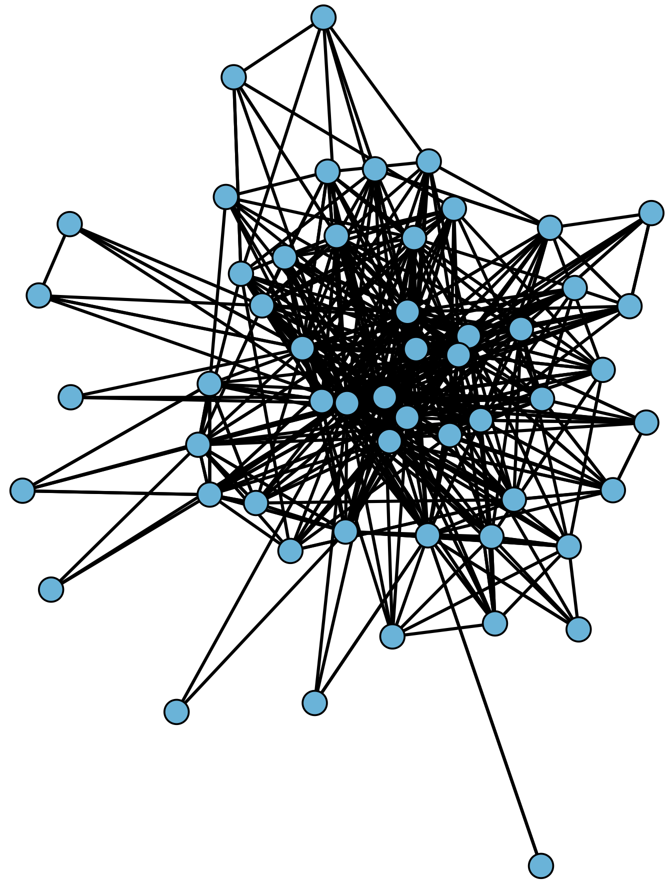
CS Champions also reported engaging with one another through informal interactions outside the formal monthly meetings and other EWIG: CS activities. Three focus group participants offered detailed descriptions of informal interactions and opportunities to network, such as introducing CS Champions to others who are knowledgeable in specific computer science content or processes. Only one focus group participant shared that they did not interact or collaborate with any other CS Champion outside of formal monthly meetings and other EWIG: CS activities. This person reflected, “I’m not feeling a network of CS Champions . . . I attend my regional meetings . . . and that’s it. I don’t see an opportunity for a network unless I initiate something.”

Overall Network Strength

An analytic technique known as social network analysis enables researchers to describe interactions within social settings and how the structure of interactions relates to broader phenomena of interest. To assess how the CS Champions operated as a community around EWIG: CS goals, the AIR team created and analyzed a survey to examine their communication patterns as a social network, with the understanding that communication about these topics provided an opportunity for CS Champions to share their knowledge surrounding CS Champion work.

Networks are composed of two things, the nodes (the actors) and the edges (the relationships between those actors). We plot them in Exhibit 18, which presents the full network diagram, wherein each node (depicted as a blue circle) represents a CS Champion and the lines between them represent an instance of communication between the two individuals on at least one occasion outside the formal activities of the EWIG: CS grant.

Exhibit 18. CS Champions Network Diagram



Note. n = 48, reporting on the network of 54 CS Champions. *Source:* CS Champion survey.

There are 407 total relationships in this network, with an average of 15.1 communication ties. The plotting algorithm here is known as Fruchterman-Reingold (1991). It seeks to place actors who are more prominent in the network (assessed via the number of people who have relationships with them) toward the center and people who are less active toward the edges. Exhibit 18 demonstrates that there is a group of people who are more actively communicating; we found 85% of the network have at least five communication ties, but 26% of the network have at least 20 communication ties. Despite this variation among members of the network, it is noteworthy that the entire network is connected. That is, each CS Champion can "reach" any other member of the CS Champion network. Because there are other social environments characterized by sharp bifurcations or social divisions in communication among individuals, this is a nontrivial piece of evidence that suggests that the CS Champions are functioning as a cohesive group.

The bi-components visible in Exhibit 18 are an indicator of the strength of connections among members of the CS Champion network. In social network analysis, the term bi-component refers to the existence of two paths from any one node to another node in the network. Bi-components are a key measure of robustness because the removal of any one tie or any one node still yields a connected network. In the context of EWIG: CS, for example, if one CS Champion leaves their position, other members of the network will still have a connection to other CS Champions in their absence. The fact that 53 individuals out of 54 are a part of the bi-component in the aggregated communication network suggests that the overall CS Champion community is robust to turnover for connecting about issues relevant to computer science education.

Characteristics of the CS Champion Network

Beyond overall findings about the CS Champion network, further exploration enables us to better understand the connections that exist among members based on their history with the grant and their geographical location.

Relationship Maturity

CS Champion descriptions of their roles highlighted the connections they have with peers through multiple channels, for example, through groups such as CS for NorCal or MSCS. We might reasonably wonder whether the EWIG: CS grant has fostered the development of new relationships or whether it primarily serves as a vehicle for maintaining existing relationships. In other words, is EWIG: CS contributing to a growing community of computer science educators and administrators? Our data do not allow for conclusions about the causality of the CS Champion network connections. However, survey data do reveal that 49% of the ties among CS Champions were formed prior to the EWIG: CA grant. More than half of the ties (51%) formed during the EWIG: CS life cycle, indicating that the grant period coincides with the development of new relationships among CS Champions.

Race, Gender, and Computer Science Experience

Because the field of computer science is one in which women and people of color have been historically underrepresented, it is important to understand whether experiences with the EWIG: CS grant differ among educators with different racial and gender backgrounds. Indeed, findings from Summer of CS participants in 2024 suggest that changes in confidence to teach computer science were greater for women, educators of color, and educators without any prior computer science teaching experience. We therefore tested the ties for each CS Champion based on their tenure working in computer science education. We find no statistical evidence ($p = 0.35$) that there is any relationship between one's experience as a computer science educator and one's position in the CS Champion communication network. This finding precludes any concerns that more junior or more senior educators would be more engaged in the CS Champion community and suggests a more egalitarian exchange of experiences. We also examined whether gender or having an underrepresented racial identity would have any relation with the number of ties CS Champions had in the network, and we find no statistical evidence that a CS Champion's gender (p = 0.74) or racial identity (p = 0.85) has any relationship with one's position in the CS Champion network.

Regional Connections

Survey responses also enable us to explore connections across the state of California. The EWIG: CS grant organizes county offices of education into seven regions.[9] Regions design professional learning opportunities together and often bring CS Champions together outside the context of statewide grant participant meetings. An examination of network ties enables us to explore the degree to which connections exist both within and across regions. To help us understand the regional context, Exhibit 19 displays the number of CS Champions within each region. Region 6, which is located in Southern California and includes many large urban school districts, has the highest number of CS Champions, with 12. Region 2, which features primarily small rural school districts along California's northern coast, has the lowest representation with 2 CS Champions.

Exhibit 19. Number of CS Champions, by Region

Region	Number of CS Champions
1	6
2	2
3	9
4	8
5	8
6	12
7	9
Total	**54**

Exhibit 20 provides a count of ties among members of the CS Champions network. Each tie represents a connection between two members. Therefore, the table displays these ties by showing the region to which one individual belongs in the columns across the top of the table and the region to which the other individual belongs in the row down the left side of the table.

[9] For a full list of the 58 California county offices of education and the regions with which they are associated within the EWIG: CS grant, see Appendix H.

Exhibit 20. CS Champion Network Ties Within and Across Regions

	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
Region 1	11						
Region 2	3	1					
Region 3	9	3	23				
Region 4	0	3	10	15			
Region 5	9	0	22	7	24		
Region 6	4	3	29	8	18	35	
Region 7	11	5	33	20	33	36	32

Note. n = 48, reporting on the network of 54 CS Champions. *Source:* CS Champion survey.

As we might expect, connections among CS Champions are strong within regions. For example the highest number of ties for members of Region 1 is to other members of the same region; 11 of the ties that connect CS Champions in Region 1 are to other CS Champions within Region 1.

However, Exhibit 20 also reveals substantial communication across regions. For example, there are 29 ties between Region 3 and Region 6. Region 1 is one of the regions with the smallest number of CS Champions, yet survey results find 9 ties apiece between Region 1 and both Regions 3 and 5. CS Champions from Region 7 appear to be especially well connected. The number of ties with Region 7 is higher for five regions (Regions 2, 3, 4, 5, and 6) than the number of ties observed *within* those regions.

Topics That Connect the CS Champion Network

We can develop a more nuanced understanding of the CS Champions network by exploring not only *who* is connecting to one another but what they are connecting *about.*

Measures of communication density help us understand the relative frequency of different topics of communication. Communication density represents the fraction of communication ties that exist out of the total possible number of communication ties that could exist; Exhibit 21 shares the communication density for 12 different topic areas about which CS Champions might interact with one another. The most common topics for connection were EWIG-specific events and capacity building in computer science education. This is unsurprising because these are the primary areas of focus for grant funding overall. The least discussed topic among CS Champions was funding. Thus, although CS Champions identify funding as one of the most significant barriers to progress in computer science education (Exhibit 15 under Barriers to

Progress), it is not a topic about which members of the CS Champions Network engage at high levels.

Exhibit 21. Communication Density About Different Topics

Topic	Density
Any Interaction	0.284
EWIG-specific events	0.218
Capacity building in CS education (e.g., coaching, workshops)	0.212
CS content and/or state CS standards	0.169
CS instructional resources	0.154
Equity and inclusion in CS education	0.145
CS availability/access	0.124
CS student engagement/experience	0.115
CS enrollment/participation	0.114
Quality professional learning standards (QPLS)	0.109
Funding for CS education	0.104
Policies related to CS education	0.087
Other topics	0.036

Note. n = 48, reporting on the network of 54 CS Champions. *Source:* CS Champion survey.

Areas for Attention

This report details some important areas of progress associated with the EWIG: CS grant. The experiences of workshop participants and CS Champions also draw attention to some key issues that will shape the success of ongoing efforts to expand and improve CS education efforts in California. Because EWIG: CS is a one-time funding stream whose formal professional learning supports will close in 2025, considerations for how to build on successes and sustain the momentum for computer science education are especially important.

We first emphasize that, across the board, findings about Summer of CS workshops and the CS Champion experience are overwhelmingly positive. The evidence presented here suggests that EWIG: CS has created a strong foundation from which to build as leaders in the computer science education community seek to continue and expand capacity-building efforts. Nevertheless, there are always opportunities to learn from both successes and challenges. We close our report by highlighting some areas of attention for the state of California to address as it considers how best to support computer science education in the state.

Approaches to Recruitment

Summer of CS participant survey results find that changes in confidence between the beginning and the end of their summer workshops are greater for educators who have historically been underrepresented in computer science education. Although the EWIG: CS grant has provided financial resources to incentivize participation in Seasons of CS workshops, those same opportunities may not be available when funding expires. Leaders in California’s computer science education community might consider prioritizing the educators they target for future opportunities, including the possible implication of recruiting educators who stand to benefit most from participation. These same leaders might also consider the value of orientation workshops in sparking interest for future learning and workshop participation. One in five Summer of CS workshop participants in 2024 previously attended an orientation workshop; a deeper analysis of attendance patterns might help EWIG: CS organizers reflect on the effectiveness of these orientation workshops as recruitment tools.

Long-Term Outcomes

Participant perspectives about their Summer of CS experiences offer promising evidence about the value of EWIG: CS workshops and their ability to shift confidence and beliefs. These are important intermediate outcomes that speak to the first component of the CAPE Framework, capacity. However, they are valuable measures of capacity only to the extent that they lead to concrete changes in classroom practice. Moreover, educator confidence and beliefs must serve improvement in the remaining framework dimensions: expanding student *access*, growing student *participation*, and improving student *experiences*. Planned activities by the AIR research team, including a follow-up survey of educators designed to capture actual changes in behavior and a series of case studies intended to examine course availability and student enrollment, will add to this evidence base. Nevertheless, questions about student experiences that result from the EWIG: CS investment will be largely unanswered. Further exploration is critical to better understand how this effort moves the needle on desired results. For example, classroom observations, combined with surveys, interviews, and/or focus groups with students, can offer valuable insights about how efforts to improve computer science translate to outcomes such as student engagement, learning, and self-efficacy. Meanwhile, course grades, AP scores, and evidence about postsecondary study and workforce participation can enable a deeper understanding of how K–12 learning experiences translate to downstream student outcomes.

Onboarding for CS Champions

The evidence presented in this report suggests that the group of CS Champions have successfully cultivated a strong and mutually supportive network of computer science advocates and leaders. Nevertheless, turnover in these positions is inevitable. Several focus group participants called for a better training process for new CS Champions. Onboarding resources—some of which may already be available but not widely understood by all members of the group—can help CS Champions navigate details related to spending grant funding, processing stipends, or coordinating different sources of grant funding. Supports might also be important in building content knowledge. Because computer science remains an emerging field, especially in K–12 education, many administrators who support these efforts have no formal training themselves and may not even have computer science teaching experience. Finding ways to address the wide range of content knowledge and experience may help make all CS Champions more effective contributors in their roles.

Sustainability

CS Champion survey responses offer promising data about the sustainability of the CS Champion role and efforts to promote and support computer science education in counties and districts. Nevertheless, CS Champions clearly identified funding as a barrier to progress in advancing computer science education, and the financial resources available through EWIG: CS will soon disappear, yet funding is a comparatively infrequent topic of discussion. The dynamics of the county office of education model, elevated in both focus group and survey responses, highlight the reality that priorities and resources often shift within county offices. Questions remain about how widespread commitments can continue without the benefit of a dedicated funding stream. The California computer science education community's ability to address this challenge will shape the degree to which EWIG: CS represents the starting point of a growing effort or a short-lived window of promise in a sea of competing priorities.

Next Steps for the EWIG: CS External Evaluation

The AIR research team will continue collecting and analyzing data throughout 2025.

First, with respect to Research Question 2, this report shares insights about the value of the 2024 Summer of CS experience. However, the ultimate goal of a capacity-building investment like EWIG: CS is to change the practices of educators in ways that better serve students. Our best measures of quality for Summer of CS, then, are not the impressions of participants during their attendance but rather their behaviors when they return to schools and classrooms. The AIR evaluation team plans to explore this issue through a follow-up survey to be administered to participants during the 2025–26 school year. This follow-up survey will ask respondents about the concrete steps they have taken in the months and years after their workshop participation. The data from this survey will have limitations because the data will rely on self-reported accounts of classroom behavior. Nevertheless, additional respondent perspectives captured a year after respondents' Summer of CS experience should provide valuable information to supplement the intermediate outcomes reported here.

Even changes in educator behavior, though vitally important, do not tell us about changes in student experiences. The CAPE Framework's emphasis on access and participation calls on us to better understand whether EWIG: CS has contributed to expanded computer science opportunities for students. Unfortunately, delays in accessibility to statewide data prevent us from analyzing these outcomes across the state of California. The evaluation team will therefore analyze computer science course availability and participation data in a small number of case study districts to address Research Questions 6 and 7. These data, supplemented by interviews with educators in each district, will help improve our understanding about the degree to which opportunities have changed throughout the life of the EWIG: CS grant and the factors that educators believe have contributed to these changes.

To continue our ongoing dialogue with members of the EWIG: CS planning team and contribute to the growing knowledge base of the computer science education community, AIR will release reports and summaries of our findings as each piece of data collection and analysis concludes. A summative annual report planned for January 2026 will summarize all findings from the upcoming year.

References

Ashcraft, C., Eger, E. K., & Scott, K. A. (2017). Becoming technosocial change agents: Intersectionality and culturally responsive pedagogies as vital resources for increasing girls' participation in computing. *Anthropology & Education Quarterly*, *48*(3), 233–251. https://doi.org/10.1111/aeq.12197

Bureau of Labor Statistics, U.S. Department of Labor. (2024). *Occupational outlook handbook*: *Computer and information research scientists*. https://www.bls.gov/ooh/computer-and-information-technology/computer-and-information-research-scientists.htm

California Department of Education. (2018). *Computer science standards for California public schools, kindergarten through grade twelve.* California Department of Education. https://www.cde.ca.gov/be/st/ss/documents/csstandards.pdf

Carnevale, A. P., Smith, N., Van Der Werf, M., & Quinn, M. C. (2023). *After everything: Projections of jobs, education, and training requirements through 2031.* Georgetown University Center on Education and the Workforce.

Code.org, CSTA, ECEP Alliance. (2024). *2024 state of computer science education*. Retrieved from https://advocacy.code.org/stateofcs

Commission on Teacher Credentialing. (2024, April). *Teacher supply in California 2022–23: A report to the legislature.* https://www.ctc.ca.gov/docs/default-source/commission/2022-23-teacher-supply-report-final.pdf

Cutts, Q., Robertson, J., Donaldson, P., & O'Donnell, L. (2017). An evaluation of a professional learning network for computer science teachers. *Computer Science Education*, *27*(1), 30–53. https://doi.org/10.1080/08993408.2017.1315958

Flapan, J. (2024, May). *Optimizing for equity in computer science education* [Commentary]. Policy Analysis for California Education. https://edpolicyinca.org/newsroom/optimizing-equity-computer-science-education

Flapan, J., Ryoo, J. J., Hadad, R., & Knudson, J. (2021). Preparing school leaders to advance equity in computer science education. *Journal of Computer Science Integration*, *4*(1), 2–15. http://doi.org/10.26716/jcsi.2021.10.8.33

Fletcher, C. L., & Warner, J. R. (2021). CAPE: A framework for assessing equity throughout the computer science education ecosystem. *Communications of the ACM, 64*(2), 23–25. https://doi.org/10.1145/3442373

Fruchterman, T. M., & Reingold, E. M. (1991). Graph drawing by force-directed placement. *Software: Practice and experience*, *21*(11), 1129–1164. https://doi.org/10.1002/spe.4380211102

John, J. P. & Carnoy, M. (2017). *Race and gender trends in computer science in the Silicon Valley from 1980–2015.* https://cepa.stanford.edu/sites/default/files/JohnCarnoy_Sept2017.pdf

Margolis, J. (2008). *Stuck in the shallow end: Education, race, and computing.* MIT Press.

Miller, D. I., Lauer, J. E., Tanenbaum, C., & Burr. L. (2024). The development of children's gender stereotypes about STEM and verbal abilities: A pre-registered meta-analytic review of 98 studies. *Psychological Bulletin, 150*(12), 1363–1396. https://doi.org/10.1037/bul0000456

Newell, A., Perlis, A. J., & Simon, H. A. (1967). Computer science. *Science, 157*(3795), 1373–1374. https://doi.org/10.1126/science.157.3795.1373.c

Roser, M. (2023). *Technology over the long run: Zoom out to see how dramatically the world can change within a lifetime*. Our World in Data. https://ourworldindata.org/technology-long-run

Scott, A., Koshy, S., Rao, M., Hinton, L., Flapan, J., Martin, A., & McAlear, F. (2019). *Computer science in California's schools: An analysis of access, enrollment, and equity*. Kapor Center. https://www.kaporcenter.org/wp-content/uploads/2019/06/Computer-Science-in-California-Schools.pdf

Strohl, J., Gulish, A., & Morris, C. (2024). *The future of good jobs: Projections through 2031.* Georgetown University Center on Education and the Workforce.

Yadav, A., Gretter, S., Hambrusch, S., & Sands, P. (2016). Expanding computer science education in schools: Understanding teacher experiences and challenges. *Computer science education*, *26*(4), 235–254. https://doi.org/10.1080/08993408.2016.1257418

Zippia. (2023). *Computer scientist demographics and statistics in the US.* https://www.zippia.com/computer-scientist-jobs/demographics/

Appendix A. Summer of CS 2024 Survey Instruments

Pre-workshop Survey

Q1: Please indicate your level of disagreement or agreement with the following statements. I am confident in my ability to…

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Teach computer science.					
Articulate to administrators why computer science education is important.					
Articulate to students why computer science education is important.					
Answer student questions about computer science material.					
Teach a stand-alone computer science class.					
Incorporate computer science content into another subject area.					
Teach in alignment with the California computer science standards.					
Assess students' learning and performance in computer science.					

Q2: Please indicate your level of disagreement or agreement with the following statements. I am confident in my ability to…

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Recruit more students from the **general student population** to pursue computer science education.					
Encourage retention from the **general student population** in computer science education.					

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Create a sense of belonging for the **general student population** in computer science education.					

Q3: Please indicate your level of disagreement or agreement with the following statements. I am confident in my ability to…

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Recruit more **underrepresented students** to pursue computer science education.					
Encourage retention from **underrepresented students** in computer science education.					
Create a sense of belonging for **underrepresented students** in computer science education.					

Q4: Please indicate your level of disagreement or agreement with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
All students should learn the fundamentals of computer science.					
All students can master the skills taught in computer science.					
Learning computer science will help my students succeed later in life.					
All students can do well on computing tasks with the right teaching and learning supports.					
All students can understand concepts underlying computer processes.					

Post-workshop Survey

Q1: Did you take the pre-workshop survey for this workshop?

- ☐ Yes (If yes, continue)
- ☐ No (If no, skip to the FLAG below)

Q2: Please indicate your level of disagreement or agreement with the following statements. I am confident in my ability to…

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Teach computer science.					
Articulate to administrators why computer science education is important.					
Articulate to students why computer science education is important.					
Answer student questions about computer science material.					
Teach a stand-alone computer science class.					
Incorporate computer science content into another subject area.					
Teach in alignment with the California computer science standards.					
Assess students’ learning and performance in computer science.					

Q3: Please indicate your level of disagreement or agreement with the following statements. I am confident in my ability to…

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Recruit more students from the **general student population** to pursue computer science education.					
Encourage retention from the **general student population** in computer science education.					

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Create a sense of belonging for the **general student population** in computer science education.					

Q4: Please indicate your level of disagreement or agreement with the following statements. I am confident in my ability to…

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Recruit more **underrepresented students** to pursue computer science education.					
Encourage retention from **underrepresented students** in computer science education.					
Create a sense of belonging for **underrepresented students** in computer science education.					

Q5: Please indicate your level of disagreement or agreement with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
All students should learn the fundamentals of computer science.					
All students can master the skills taught in computer science.					
Learning computer science will help my students succeed later in life.					
All students can do well on computing tasks with the right teaching and learning supports.					
All students can understand concepts underlying computer processes.					

Q6: (IF Q1 = No) Please indicate your level of disagreement or agreement with the following statement: As a result of participating in the workshop, my confidence in my ability to do the following increased:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Teach computer science					
Articulate to administrators why computer science education is important					
Articulate to students why computer science education is important					
Answer student questions about computer science material					
Teach a stand-alone computer science class					
Incorporate computer science content into another subject area					
Teach the computer science concepts required by the curriculum					
Assess students' learning and performance in computer science					

Q7: (IF Q1 = No) Please indicate your level of disagreement or agreement with the following statement: As a result of participating in the workshop, my confidence in my ability to do the following increased:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Recruit more students from the **general student population** to pursue computer science education					
Encourage retention from the **general student population** in computer science education					
Create a sense of belonging for the **general student population** in computer science education					

Q8: (IF Q1 = No) Please indicate your level of disagreement or agreement with the following statement: As a result of participating in the workshop, my confidence in my ability to do the following increased:

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Recruit more **underrepresented students** to pursue computer science education					
Encourage retention from **underrepresented students** in computer science education					
Create a sense of belonging for **underrepresented students** in computer science education					

Q9: Please indicate your level of disagreement or agreement with the following statements.

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
The content covered was relevant to my school or district.					
The curriculum embedded discussion of equity, diverse cultures, and perspectives in learning computer science.					
The workshop is a useful experience for educators integrating computer science education programs in their school or district.					
The presentation format for the workshop was appropriate for meeting the stated goals.					
I have confidence in the expertise of the facilitators.					
The workshop made me feel included in a community of computer science educators and advocates.					
The benefits of attending were worth the time I invested.					

Q6: What were the most helpful aspects of the workshop?

____

Q7: What were the aspects of the workshop that could be improved upon?

____

Q9: Is your school a participant of CS4NorCal?

- ☐ Yes
- ☐ No
- ☐ I don’t know

Appendix B. Summer of CS 2024 Survey Response Rate Analysis

Survey responses are most effective as tools for understanding workshop participant experiences when we believe that those responses are reflective of the full set of workshop participants. High overall response rates—with 95% of participants completing at least one survey and 78% completing both the pre-workshop and post-workshop surveys—build our confidence about the representative nature of the findings reported in this document. Exhibit B–1 displays the results of a nonresponse analysis in which we examine response rates based on respondent characteristics. Although we find small differences in some racial identity categories, none of these are statistically significant.

Exhibit B–1. Gender and Race/Ethnicity of Survey Respondents and Nonrespondents

Category	Summer of CS Participants	Survey Respondents	Survey Nonrespondents
Woman	77%	77%	78%
Man	20%	20%	22%
African American	2%	2%	3%
American Indian or Alaska Native	1%	1%	0%
Asian/Filipino	12%	15%	16%
Hispanic or Latino	23%	22%	32%
Pacific Islander	0%	0%	0%
White	45%	45%	41%
Two or More Racial Identities	15%	10%	3%
Racial Identity Not Reported	2%	2%	0%

Appendix C. Summer of CS 2024 Regression Analyses

Exhibit C–1 shows the output of the regression analyses described in the body of the report. Each row of the table represents a different regression, with the survey item in the far left column representing the dependent variable in the equation. In each case, the research team has converted the Likert responses from categorical variables to a numerical variable in which Strongly agree = 5, Agree = 4, Neither agree nor disagree = 3, Disagree = 2, and Strongly disagree = 1. The dependent variable represents the difference between the post-workshop response and the pre-workshop response for each respondent. The Baseline Change column displays the change for the reference group in the equation—that is, for respondents who have no prior CS teaching experience, who are male, and who identify as White or Asian but no other racial identity. A positive number in this column indicates that the average survey response has increased from the pre-workshop survey to the post-workshop survey. A negative number indicates that the average survey response has decreased from the pre-workshop survey to the post-workshop survey.

Subsequent columns show the coefficient, standard errors (in parentheses), and statistical significance (using asterisks) for the y-intercept, years of CS teaching experience, gender, and racial identity, respectively. Years of CS teaching experience is a continuous variable, and the coefficient represents the change in response for each additional year of computer science experience beyond the baseline change, controlling for gender and racial identity. Woman is a binary variable that equals 1 for respondents who identified as a woman and 0 for everyone else; the coefficient represents the change in response beyond the baseline response for women respondents, controlling for CS teaching experience and racial identity. Underrepresented racial identity is a binary variable that equals 1 for respondents who identified a racial category other than White or Asian as a racial identity and 0 for respondents who identified exclusively as White and/or Asian; the coefficient represents the change in response beyond the baseline response for respondents with an underrepresented racial identity, controlling for CS teaching experience and gender.

Exhibit C–1. Regression Output for Subgroup Analyses of Survey Respondents

Survey Item	Baseline Change	Years of CS Teaching Experience	Prefer Not to State	Woman	Under-represented Racial Identity
I am confident in my ability to teach computer science.	0.681 (0.131) ***	-0.041 (0.012) ***	0.326 (0.137) *	0.225 (0.109) *	0.681 (0.131) ***
I am confident in my ability to articulate to administrators why computer science is important.	0.386 (0.12) **	-0.02 (0.011)	0.366 (0.125) **	0.284 (0.1) **	0.386 (0.12) **
I am confident in my ability to articulate to students why computer science is important.	0.414 (0.118) ***	-0.026 (0.01) *	0.244 (0.124) *	0.178 (0.098)	0.414 (0.118) ***
I am confident in my ability to answer student questions about computer science material.	0.567 (0.127) ***	-0.049 (0.011) ***	0.489 (0.133) ***	0.273 (0.106) **	0.567 (0.127) ***
I am confident in my ability to teach a stand-alone computer science class.	0.693 (0.151) ***	-0.018 (0.013)	0.225 (0.157)	0.122 (0.125)	0.693 (0.151) ***
I am confident in my ability to incorporate computer science content into another subject area.	0.598 (0.142) ***	-0.025 (0.012) *	0.381 (0.148) *	0.200 (0.118)	0.598 (0.142) ***
I am confident in my ability to teach in alignment with California computer science standards.	0.76 (0.138) ***	-0.012 (0.012)	0.25 (0.144)	0.357 (0.114) **	0.76 0 (0.138) ***
I am confident in my ability to assess students' learning and performance in computer science.	0.604 (0.134) ***	-0.036 (0.012) **	0.421 (0.139) **	0.353 (0.111) **	0.604 (0.134) ***
I am confident in my ability to recruit more students to pursue computer science education.	0.507 (0.107) ***	-0.007 (0.009)	0.148 (0.111)	0.253 (0.089) **	0.507 (0.107) ***
I am confident in my ability to encourage students to continue pursuing computer science education.	0.431 (0.107) ***	-0.005 (0.009)	0.202 (0.111)	0.177 (0.089) *	0.431 (0.107) ***

Survey Item	Baseline Change	Years of CS Teaching Experience	Prefer Not to State	Woman	Under-represented Racial Identity
I am confident in my ability to create a sense of belonging for students in computer science education.	0.336 (0.107) **	-0.004 (0.009)	0.232 (0.111) *	0.212 (0.088) *	0.336 (0.107) **
I am confident in my ability to recruit more underrepresented students to pursue computer science education.	0.445 (0.11) ***	-0.009 (0.009)	0.226 (0.114) *	-0.025 (0.09)	0.445 (0.11) ***
I am confident in my ability to encourage underrepresented students to continue pursuing computer science education.	0.409 (0.11) ***	-0.009 (0.009)	0.216 (0.114)	0.039 (0.09)	0.409 (0.11) ***
I am confident in my ability to create a sense of belonging for underrepresented students in computer science education.	0.413 (0.103) ***	-0.004 (0.009)	0.189 (0.106)	-0.006 (0.084)	0.413 (0.103) ***
All students should learn the fundamentals of computer science.	0.145 (0.092)	-0.015 (0.008)	0.094 (0.095)	0.043 (0.074)	0.145 (0.092)
All students can master the skills taught in computer science.	0.146 (0.097)	-0.003 (0.008)	0.109 (0.1)	-0.034 (0.078)	0.146 (0.097)
Learning computer science will help students succeed later in life.	0.162 (0.086)	-0.012 (0.007)	0.080 (0.089)	0.019 (0.069)	0.162 (0.086)
All students can do well on computing tasks with the right teaching and supports.	0.2 (0.089) *	-0.009 (0.008)	0.081 (0.092)	-0.075 (0.072)	0.200 (0.089) *
All students can understand concepts underlying computer processes.	0.399 (0.097) ***	-0.011 (0.008)	-0.051 (0.1)	-0.098 (0.078)	0.399 (0.097) ***

Note. * = $p < 0.05$. ** = $p < 0.01$. *** = $p < 0.001$.

Appendix D. Summer of CS 2024 Analyses of Variation in Pre- to Post-Workshop Changes

Building on the information presented in Exhibit 7 of the report, the following charts display the changes in survey responses for each item that offers both pre-workshop and post-workshop data. In each exhibit, the black vertical line is set at 0. The blue line represents the average change for this item.

Exhibit D–1. Changes in Summer of CS Participant Confidence to Teach Computer Science

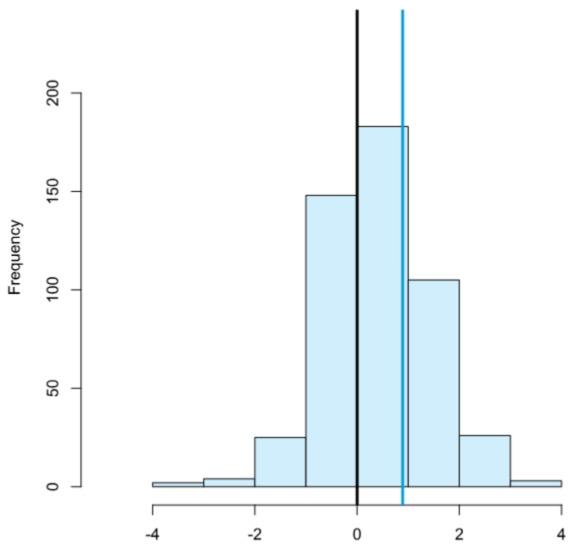


Exhibit D–2. Changes in Summer of CS Participant Confidence to Articulate to Administrators Why Computer Science Is Important

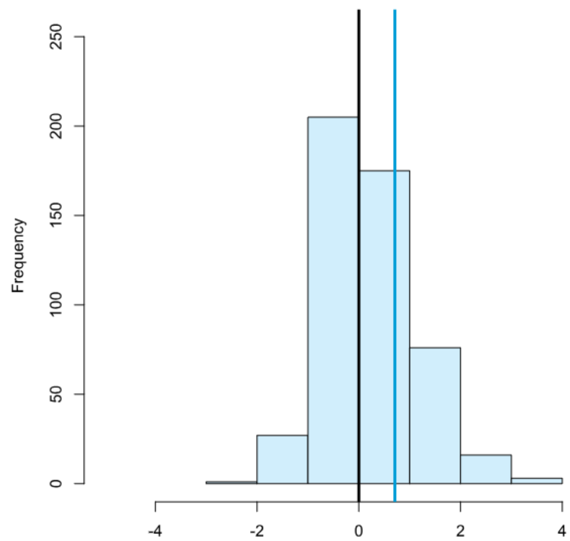


Exhibit D–3. Changes in Summer of CS Participant Confidence to Articulate to Students Why Computer Science Is Important

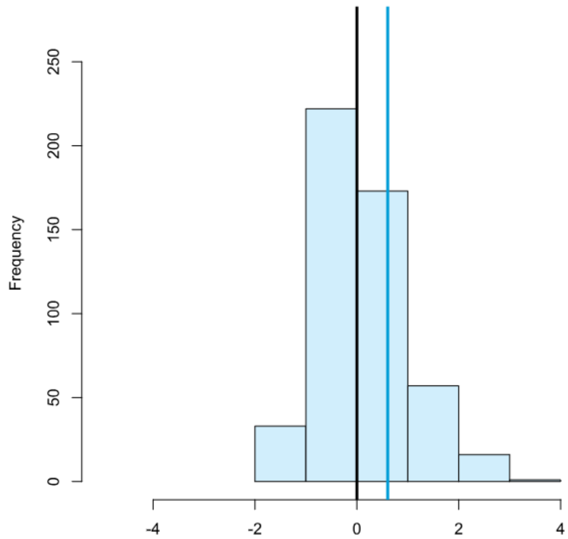


Exhibit D–4. Changes in Summer of CS Participant Confidence to Answer Student Questions About Computer Science Material

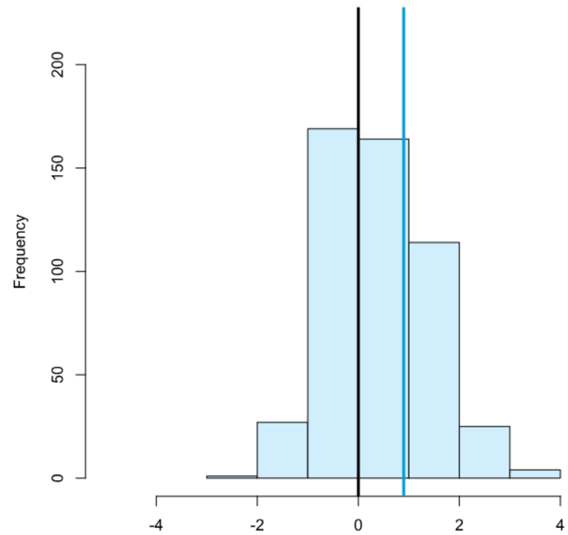


Exhibit D–5. Changes in Summer of CS Participant Confidence to Teach a Stand-Alone Computer Science Class

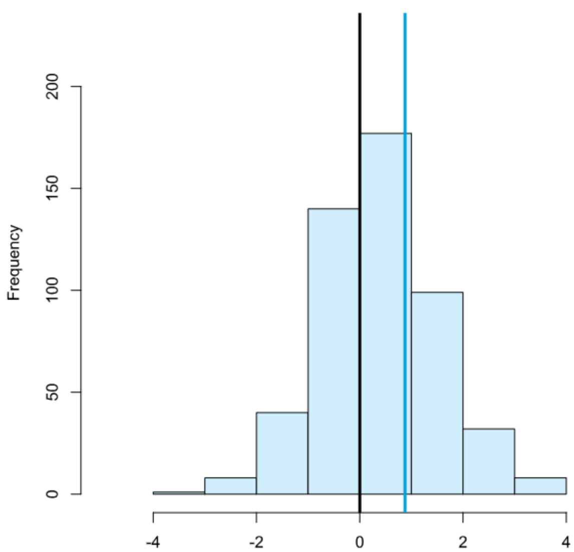


Exhibit D–6. Changes in Summer of CS Participant Confidence to Incorporate Computer Science Content Into Another Subject Area

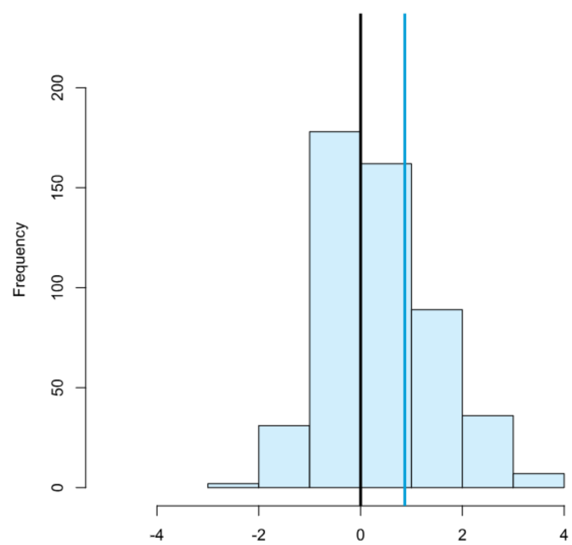


Exhibit D–7. Changes in Summer of CS Participant Confidence to Teach in Alignment With California Computer Science Standards

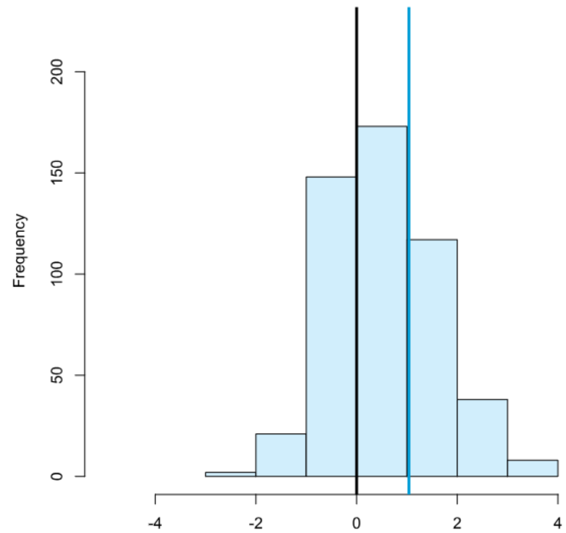


Exhibit D–8. Changes in Summer of CS Participant Confidence to Assess Students' Learning and Performance in Computer Science

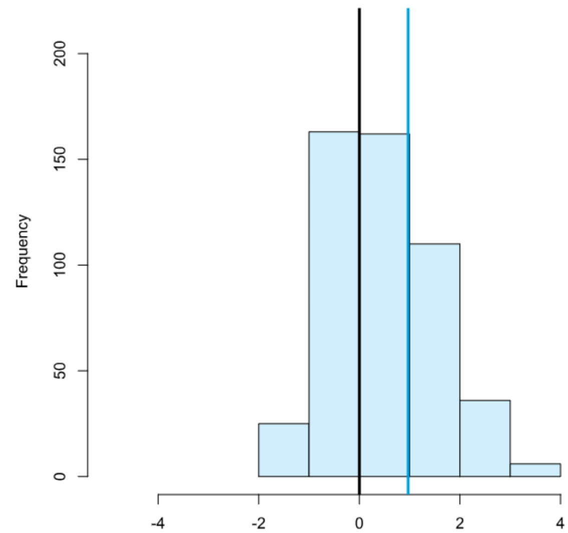


Exhibit D–9. Changes in Summer of CS Participant Confidence to Recruit More Students to Pursue Computer Science Education

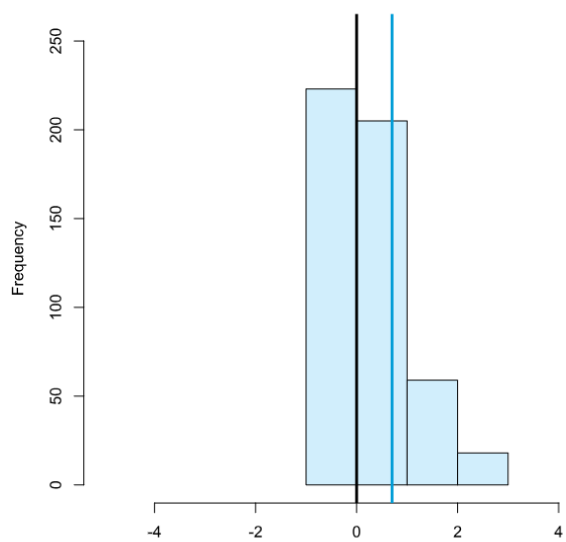


Exhibit D–10. Changes in Summer of CS Participant Confidence to Encourage Students to Continue Pursuing Computer Science Education

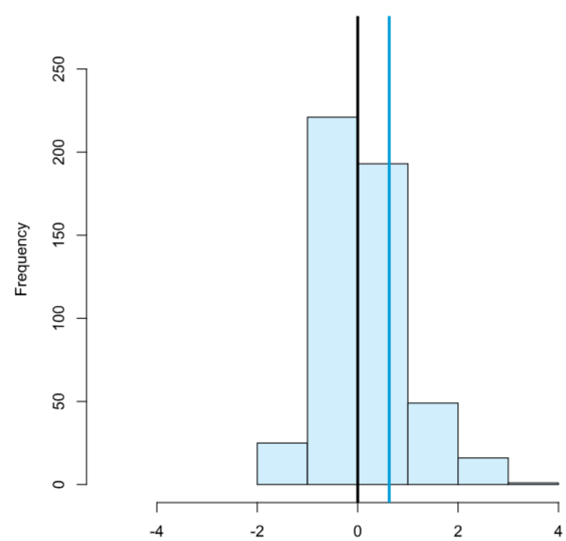


Exhibit D–11. Changes in Summer of CS Participant Confidence to Create a Sense of Belonging for Students in Computer Science Education

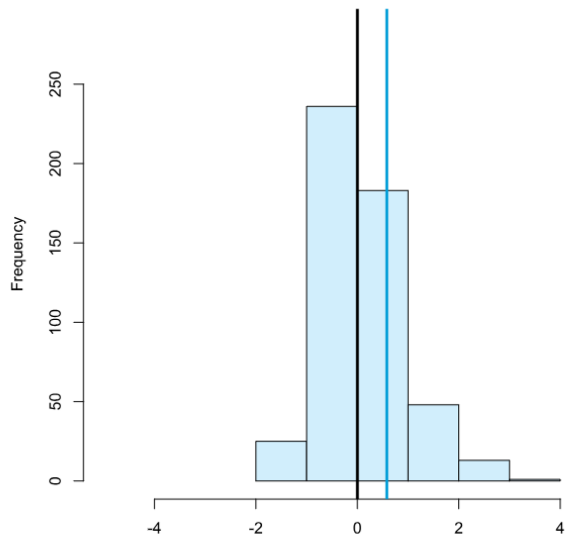


Exhibit D–12. Changes in Summer of CS Participant Confidence to Recruit More Underrepresented Students to Pursue Computer Science Education

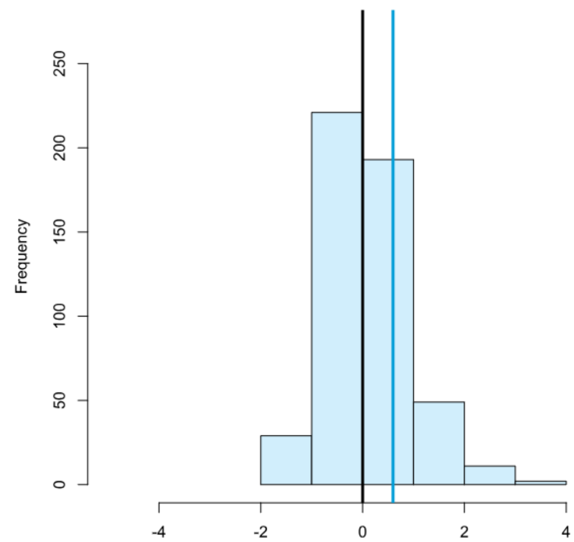


Exhibit D–13. Changes in Summer of CS Participant Confidence to Encourage Underrepresented Students to Continue Pursuing Computer Science Education

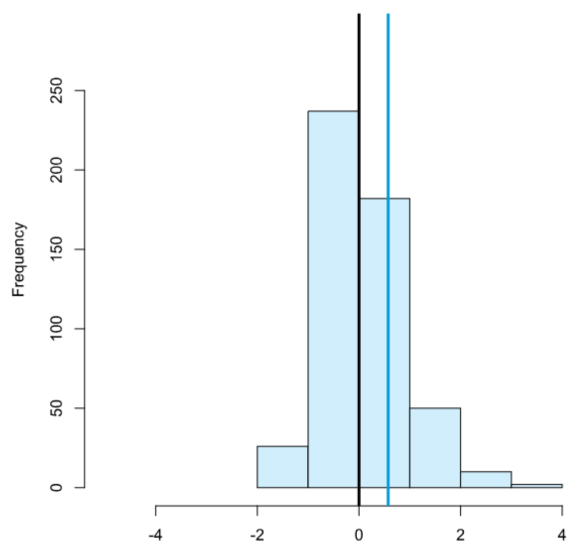


Exhibit D–14. Changes in Summer of CS Participant Confidence to Create a Sense of Belonging for Underrepresented Students in Computer Science Education

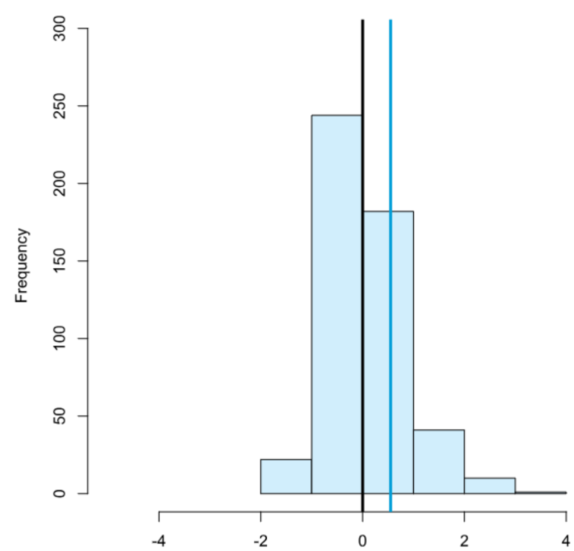


Exhibit D–15. Changes in Summer of CS Participant Beliefs That All Students Should Learn the Fundamentals of Computer Science

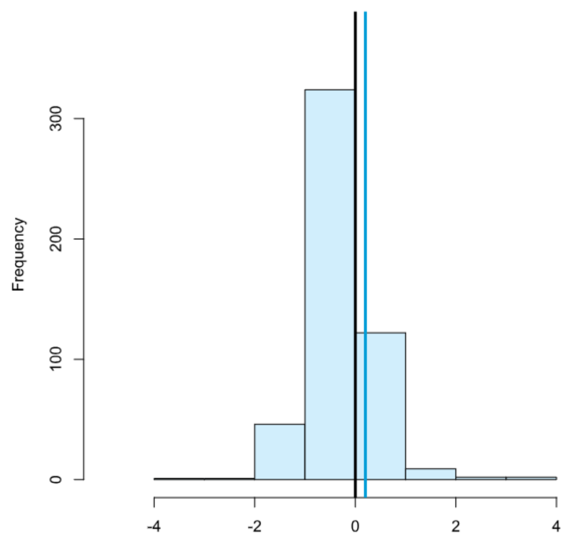


Exhibit D–16. Changes in Summer of CS Participant Beliefs That All Students Can Master the Skills Taught in Computer Science

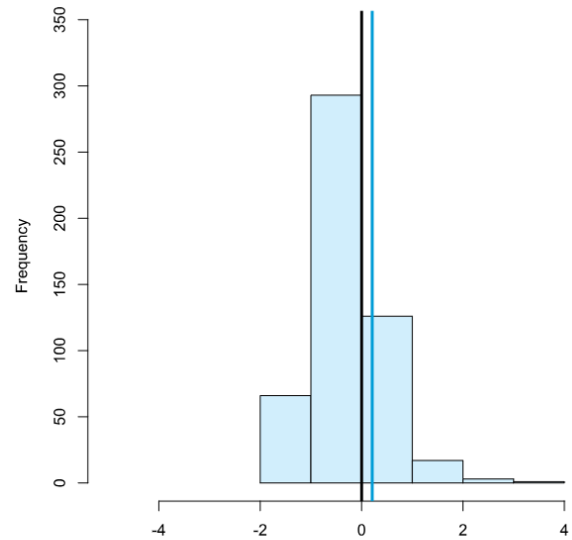


Exhibit D–17. Changes in Summer of CS Participant Beliefs That Learning Computer Science Will Help Students Succeed Later in Life

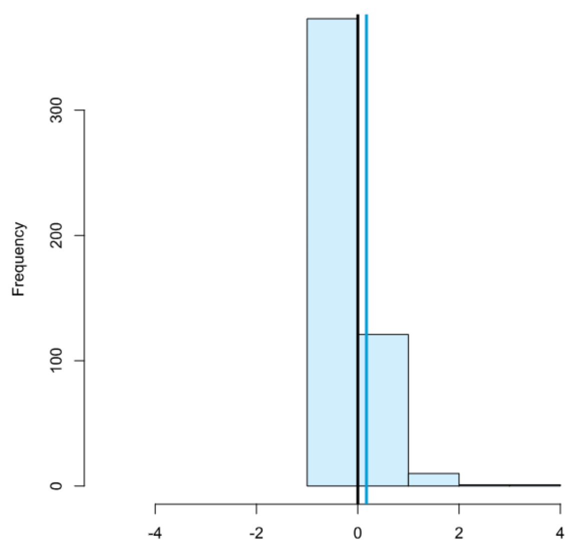


Exhibit D–18. Changes in Summer of CS Participant Beliefs That All Students Can Do Well on Computing Tasks With the Right Teaching and Supports

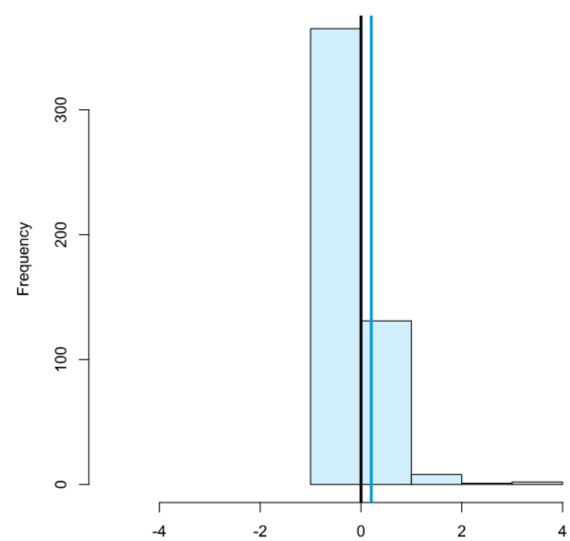
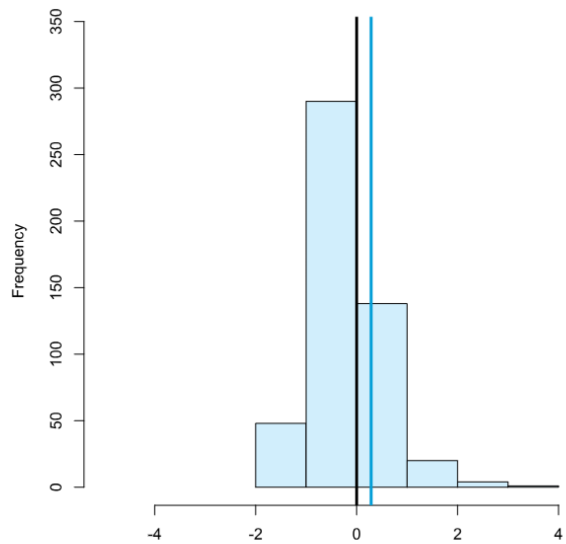


Exhibit D–19. Changes in Summer of CS Participant Beliefs That All Students Can Understand Concepts Underlying Computer Processes



Appendix E. CS Champion Survey Instrument

Q1: **EWIG has created multiple opportunities for CS champions to convene in person. Which of the following in-person events have you attended?**

- CS Champions Coaching Academy, Manhattan Beach, August 10-11, 2023
- STEAM Symposium, Long Beach, February 8, 2024
- School Leadership Workshop, UCLA, February 26-27, 2024
- CSPDWeek, Anaheim, July 22-26, 2024

Q2: **EWIG has hosted monthly Zoom calls for CS Champions that take place on Tuesday mornings. Select the option which best describes your attendance below.**

- I have attended none of the calls.
- I have attended less than half of the calls.
- I have attended roughly half of the calls.
- I have attended more than half of the calls.
- I have attended all of the calls.

Q3: **In addition to formal EWIG convenings referenced in the previous two questions, we understand that CS champions might interact with one another in other contexts. These could include regional meetings, other events, or one-on-one communication. Of the following people, who have you communicated with about issues related to CS education <u>outside</u> the context of the formal EWIG activities that are designed for <u>all</u> CS champions?**

Please note: Communication here is defined as any in-person conversation, virtual conversation, text message, or email exchange.

[Respondent sees a list of all CS champions]

Q4: **When you communicate with [name selected in Q3] about CS topics, what are the specific topics on which you focus?** *Select all that apply.*

- CS content and/or state CS standards
- Capacity-building in CS education (e.g., coaching, workshops)
- Quality professional learning standards (QPLS)
- Equity and inclusion in CS education
- Policies related to CS education
- CS instructional resources
- CS availability / access
- CS enrollment / participation
- CS student engagement / experience
- Funding for CS education
- EWIG-specific events
- Other topics (please specify)

Q5: **Were you in contact with this individual prior to your participation in EWIG?**

- Yes
- No

Q6: We understand that there are barriers that stand in the way of equitably expanding CS education in California. Please rate the significance of the following barriers on a scale of 0 to 10. *If you believe an item on this list is a barrier significantly impeding California computer science education, please rate it as a 10. If you believe that an item on the list is not a barrier, please rate it as a 0.*

- Funding
- Access to devices and connectivity
- Availability of instructional materials
- Discrimination or bias related to student background or identity
- Availability of qualified CS educators
- Training or professional development for CS educators
- Student interest in CS education
- Social familial influence
- CS education policies
- Administrator or counselor buy-in and support
- Competing priorities and initiatives
- Other (please specify)

Q7: **How effective do you feel the EWIG grant has been in helping you to address these barriers?** [Survey skip logic will carry forward anything from Q6 rated above 0. Response options: Not effective at all, Slightly effective, Moderately effective, Very effective, Extremely effective].

- Funding
- Access to devices and connectivity
- Availability of instructional materials
- Discrimination or bias related to student background or identity
- Availability of qualified CS educators
- Training or professional development for CS educators
- Student interest in CS education
- Social familial influence
- CS education policies
- Administrator or counselor buy-in and support
- Competing priorities and initiatives
- Other (please specify)

Q8: **To what extent do you agree or disagree with the following statements?**

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
I understand my role as a CS champion.					
The training and supports I have received as a CS champion have increased my capacity to equitably expand CS education.					
The EWIG grant has given me a better understanding of the Quality Professional Learning Standards and how to use them in professional development contexts.					
Members of the community of CS champions provide support to each other.					
Members of the lead organizations for the EWIG grant make equity a priority in implementing the grant.					

Q9: **Is there a workshop, meeting, or conversation that was especially influential in shifting your thinking about equity in CS education? If so, please describe.**

____

Q10: **Which of the following recruitment approaches have you used to promote educator attendance at Seasons of CS orientation workshops, summer workshops, and academic year workshops?** *Select all that apply*.

- Email announcements
- Conference presentations
- Announcements at other educator-focused events
- Social media posts
- Direct outreach from you or other CS champions
- Direct outreach from a district or school administrator
- Direct outreach from a colleague at the same school
- Direct outreach from a friend or colleague
- Stipend for participation

Q11: **Please rank the effectiveness of the following recruitment approaches in promoting educator attendance at Seasons of CS orientation workshops, summer workshops, and academic year workshops.** [Display response options selected in Q10.]

- Email announcements
- Conference presentations
- Announcements at other educator-focused events
- Social media posts
- Direct outreach from you or other CS champions
- Direct outreach from a district or school administrator
- Direct outreach from a colleague at the same school
- Direct outreach from a friend or colleague
- Stipend for participation

Q12: **To what extent do you agree or disagree with the following statements?**

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
CS education is a priority within my county office of education.					
All of my county office of education responsibilities are connected to CS education.					
I have enough time in my schedule to meet my CS champion responsibilities.					
I have colleagues within my county office of education who support my efforts to promote CS education.					
The districts in my county understand the importance of CS education.					
The districts in my county promote CS education.					
There is sufficient funding in my county office of education to support CS education.					

Q13: **In the past 12 months, how often have you used each of the following data sources to inform your work as a CS champion**?

	Never	A few times	Once per month	2-3 times per month	Once per week	More than once per week
Course enrollment data						
Course grades						
College Board data on AP test performance						
Seasons of CS participation data in Airtable						
Professional learning experience data						
CSforCA data tool						
Student feedback						
Other (please specify)						

Q14: **To what extent do you agree or disagree with the following statements?**

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
My county office of education has the capacity continue supporting CS education.					
My county office of education is the best provider of support for CS education in my county.					
I will be able to effectively support CS education after the end of the EWIG grant.					

Q15: What resources, supports, or strategies <u>have you received</u> through EWIG that will support you as you move forward with your efforts to promote computer science education in your context after the EWIG grant ends?

____

Q16: What resources, supports, or strategies <u>do you need</u> to continue your efforts to promote computer science education in your context after the EWIG grant ends?

____

Q17: **How long have you been working in computer science education?**

- (INTEGER) years

Q18: **What regard to racial identity, how would you best describe yourself?**

- American Indian, Native American, or Alaskan Native
- Asian
- Black or African American
- East Indian or Indian
- Filipino/a/x
- Latino/a/x or Hispanic
- Middle Eastern or North African
- Native Hawaiian or Pacific Islander
- White or Caucasian
- Prefer not to state

Q19: **With regard to gender identity, how would you best describe yourself?**

- Gender-fluid
- Man
- Non-binary
- Transgender
- Woman
- Prefer not to state

Appendix F. CS Champion Focus Group Protocol

[Background Information/Introductions]

Let's take a few moments for introductions.

Please tell us about your current role—your title, how long you've held this position, and your responsibilities related to computer science (CS), if it applies.

[RQ Strand 1: What insights do CS Champions have about their role in equitably expanding CS education?]

Now that we understand your professional role and its relation to computer science, we are interested in learning specifically about your role as a CS Champion for Seasons of CS.

- How would you explain your role as a CS Champion to someone who knew nothing about it?
- How do you see the group of CS Champions as contributing to equitably expanding CS education in California as a whole?
  - PROBE: In your personal capacities as CS Champions, at what levels of our education system are you operating? By levels I mean, school, district, county office, etc.
  - PROBE: What are the biggest changes that you have seen as the result of your work?
  - PROBE: What accomplishments are you most proud of in your work as a CS Champion?
  - PROBE: Are there developments that have happened in the last year that would not have happened without you or others being in the CS Champion role?
  - PROBE: You just mentioned [X]. What are the actions you have taken as a CS Champion that made the biggest difference in accomplishing [X]?
- What advice do you have for the state of California in its pursuit to sustainably expand equitable CS education?
- We understand that the work in which you've engaged as CS Champions has been made possible, in part, by funding through the EWIG grant. How do you anticipate that your role will evolve after the grant period? What do you anticipate will happen with the network of CS Champions?

[RQ Strand 2: To what extent do CS Champions believe that the training and support they receive has adequately prepared them to carry out their work?]

We have talked some about your work as CS Champions. Now I'd like to move our conversation toward the training and ongoing support you have received to prepare you to carry out the work.

- Can you describe the trainings and supports you have received as a CS Champion?
  - PROBE: What types of training and ongoing supports have been helpful?
  - PROBE: How could trainings and existing ongoing supports be improved?
- How do these trainings model the Quality Professional Learning Standards?
  - PROBE: From what I understand, there has been a strong equity focus for some of these trainings and supports. What have these entailed? Can you describe their impact on you as a CS Champion?
- What additional types of training or ongoing support, if any, do you feel like you would need to be more effective in your role as a CS Champion?

[RQ Strand 3: What is the nature and frequency of interactions among CS Champions outside formal professional learning activities?]

Now we will chat about CS Champions as a network.

- I understand that many of these trainings and other supports have been made available in group settings to the full set of CS Champions. How would you describe the network of CS Champions?
- To what extent do you interact with other CS Champions outside the context of these formal statewide conversations?
  - PROBE: Who do you interact with?
  - PROBE: What is the nature of your interaction?
  - PROBE: What kind of impact have these interactions had?
- Is there anything that could help this network operate more effectively?

[Anything else?]

We've covered a lot of ground in this conversation, but I always like to reserve a few minutes to let you drive the conversation.

- Is there anything else you'd like to say? Anything that we missed that you think is important to capture?

[Closing Statement]

Thank you for your time today. This conversation has been very important to our work evaluating Seasons of CS. In the coming months, we'll be in touch with you and other CS Champions as we collect additional data through a survey. The survey will be vital to our success in conducting a social network analysis of this program, so make sure you keep an eye out for it and complete it. Thanks again!

Appendix G. CS Champions Focus Group Codebook

Code	Protocol	Example	Note
1.0 **Role**	Please tell us about your <u>current role</u>: your title, how long you've held this position, and your responsibilities related to computer science (CS), if it applies.	• STEM/CS coordinator • Director of education technologies • Program manager or specialist	Many CS Champions have been in adjacent/changing CS/math/coordinating roles over several years.
2.0 **CS Champions**			
2.1 ***CS Champions explanation***	How would you explain your <u>role as a CS Champion</u> to someone who knew nothing about it?	• Liaison • Advocates • "Connector" • Professional development provider or facilitator	
	PROBE: In your personal capacities as CS Champions, at what levels of our education system are you operating?	• School • District • County office	Not often directly asked, mostly shared in description of role.
2.2 ***Accomplishments***	What <u>accomplishments</u> are you most proud of in your work as a CS Champion?	• Collaboration • Leadership • Capacity • Interest in CS • Elementary interest • Participation in trainings	
	How do you see the group of CS Champions as <u>contributing to equitably expanding CS education</u> in California as a whole?	• Increasing coursework access	

Code	Protocol	Example	Note
		• Expanding reach to rural or central (California) areas • Targeted CS efforts to K–8 • Teacher recruitment • “CS family”	
	PROBES: Are there developments that have happened in the last year that would not have happened without you or others being in the CS Champion role? What are the biggest changes that you have seen as the result of your work? What are the biggest changes that you have seen as the result of your work?		
2.3 ***Challenges***	[Not explicitly asked on the protocol]	• Time • Funding • Teacher training • Teacher credentials • Administrator support • County office • “Volun-told”	Conversations related to challenges encountered by CS Champions/in their role should be coded here (see examples) and double coded as necessary.
3.0 **Advice to the State**	What advice do you have for the state of California in its pursuit to sustainably expand equitable CS education?	• Funding • Research and policy • CS integration • Build capacity • System alignment • Teacher training and credentialing • Continued funding	Includes threats or risks to continuing efforts to expand CS education.

Code	Protocol	Example	Note
4.0 **Sustainability**	We understand that the work in which you've engaged as CS Champions has been made possible, in part, by funding through the EWIG grant. How do you anticipate that your role will evolve after the grant period? What do you anticipate will happen with the network of CS Champions?	• CS for NorCal, Computer Science Teachers Association, etc. (other related work groups, initiatives) • Math, Science, Computer Science (MSCS) grant (or other similar funding sources)	Includes threats or risks related to EWIG, CS Champions, or the network.
5.0 **Training & Support**	Can you describe the trainings and supports you have received as a CS Champion?	• No formal trainings • Monthly meetings • Collaborate within network • Informal mentorship or coaching • Workshops (e.g., coaching, Airtable) • Conference attendance	Some participants fell silent here in most focus groups indicating that they were not aware of training/supports provided, not always evident in transcript, will turn to quantifiable measures to draw insights.
5.1 ***Helpful Training***	*PROBES*: How do these trainings model the Quality Professional Learning Standards? What types of training and ongoing supports have been helpful? From what I understand, there has been a strong equity focus for some of these trainings and supports. What have these entailed?	• Monthly meetings (regional, full team)	
5.2 ***Improvements to Training***	What additional types of training or ongoing support, if any, do you feel like you would need to be more effective in your role as a CS Champion?	• Formal opportunities	

Code	Protocol	Example	Note
6.0 **CS Champions Network**			
6.1 ***Network Explanation***	How would you describe the network of CS Champions?		
6.2 ***Interactions***	To what extent do you interact with other CS Champions outside the context of these formal statewide conversations?	• None • Collaborated training or professional development within region or cross-region • Other similar convenings (e.g., CS for NorCal, interactions within similar grants) • Ask questions from other CS Champions that other county or district staff are not aware of	
	PROBES: Who do you interact with? What is the nature of your interaction? What kind of impact have these interactions had?		
6.3 ***Improvements***	Is there anything that could help this network operate more effectively?		
7.0 **Other**	Is there anything else you'd like to say? Anything that we missed that you think is important to capture?		(1) Catch all code for challenges (double, triple coded here as necessary), (2) for background/context, and (3) in response to final open-ended question.

Appendix H. List of California County Offices of Education, by Region

EWIG: CS Region	County Office of Education
1	Butte County Office of Education
	Del Norte County Office of Education
	Glenn County Office of Education
	Humboldt County Office of Education
	Lassen County Office of Education
	Modoc County Office of Education
	Plumas County Office of Education
	Shasta County Office of Education
	Siskiyou County Office of Education
	Tehama County Office of Education
	Trinity County Office of Education
2	Lake County Office of Education
	Marin County Office of Education
	Mendocino County Office of Education
	Napa County Office of Education
	Sonoma County Office of Education
3	Alpine County Office of Education
	Amador County Office of Education
	Calaveras County Office of Education
	Colusa County Office of Education
	El Dorado County Office of Education
	Nevada County Office of Education
	Placer County Office of Education
	Sacramento County Office of Education
	San Joaquin County Office of Education
	Sierra County Office of Education
	Sutter County Superintendent of Schools
	Tuolumne County Superintendent of Schools
	Yolo County Office of Education

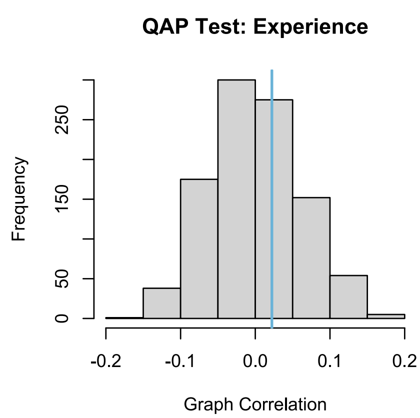
EWIG: CS Region	County Office of Education
	Yuba County Office of Education
4	Alameda County Office of Education
	Contra Costa County Office of Education
	San Francisco County Office of Education
	San Mateo County Office of Education
	Santa Clara County Office of Education
	Solano County Office of Education
5	Inyo County Superintendent of Schools
	Kings County Office of Education
	Madera County Office of Education
	Mariposa County Office of Education
	Merced County Office of Education
	Monterey County Office of Education
	Mono County Office of Education
	San Benito County Office of Education
	Santa Cruz County Office of Education
	Stanislaus County Office of Education
	Tulare County Office of Education
6	Fresno County Superintendent of Schools
	Kern County Superintendent of Schools
	Los Angeles County Office of Education
	San Luis Obispo County Office of Education
	Santa Barbara County Office of Education
	Ventura County Office of Education
7	Imperial County Office of Education
	Orange County Office of Education
	Riverside County Office of Education
	San Bernardino County Superintendent of Schools
	San Diego County Office of Education

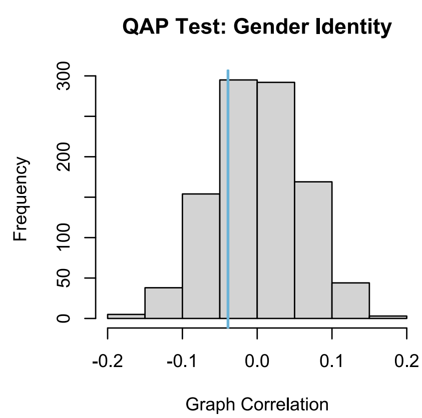
Note. EWIG: CS = Educator Workforce Investment Grant in Computer Science.

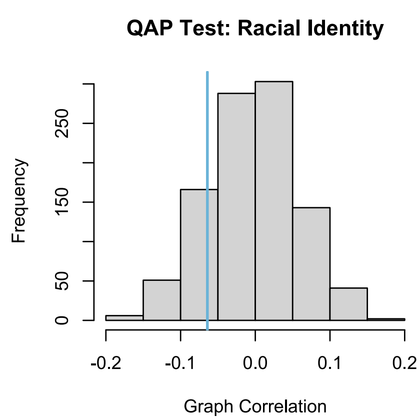
Appendix I. CS Champions Social Network Analysis

Using the quadratic assignment procedure, the AIR research team created three separate matrices, by Computer Science Champions' (CS Champions') computer science teaching experience and racial and gender identity (racial identity imputed from the *rethnicity* package in R or by examining the name for gender identity). We dichotomized individuals as having either a White or Asian (0) or a different identity (1). With respect to gender identity, because there were no non-binary people listed, individuals were either coded as a man or a woman. We imputed a nonrespondent's level of experience teaching computer science by using the median computer science experience. We examined the graph correlation between the observed graph and the respective matrix being compared. The quadratic assignment procedure permutes the graph isomorphism and then examines the respective correlation as a random draw. After permuting the graph 1,000 times to form a distribution of 1,000 random graph correlations, we can examine its relation to the observed graph correlation and provide a simulated *p*-value.

Presented below are the histograms of the random graph correlations against the observed graph alongside the CS Champions' computer science experience, gender identity, and racial identity. The blue line indicates the observed graph correlation. None of these results are statistically significant.







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