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RESPONSE TO PRIORITIES

Code.org's Equity in AP Computer Science Principles (Equity in AP CSP): Addressing Barriers to Participation in AP CSP by Transforming Professional Learning and School Leadership will address **AP 1 & AP 3 and CPP-Computer Science (CS) and produce research that meets What Works Clearinghouse (WWC) standards with reservations.** Equity in AP CSP will develop and implement (1) an outreach and recruitment program for school administrators to adopt, and for school counselors to enroll students in, AP Computer Science Principles (School Leadership Program), and (2) a blended¹ professional learning program (Blended PL Program) for AP Computer Science Principles (AP CSP) teachers that builds on Code.org's open source curriculum, associated in-person Professional Learning Program, and robust network of Regional Partners. Equity in AP CSP brings these components together to increase equitable participation and student outcomes in AP CSP for women, underrepresented minorities² (URM) and rural populations across five states – Alaska, Idaho, Kentucky, Texas, and West Virginia, each of whom have high numbers of students who are historically underrepresented in computer science.³ Equity in AP CSP will 1) train new AP CSP teachers, 2) increase the number of schools adding AP CSP into their master school schedules and 3) increase the number of women, URM, and rural students participating and earning qualifying scores on the AP CSP exam thereby demonstrating increased college readiness.

INTRODUCTION

Code.org, a nonprofit 501(c)(3), is the leading organization in the United States expanding access to high-quality computer science (CS)⁴ within the school day across K-12 and focused on increasing participation by women and URMs in CS coursework.⁵ Code.org's AP CSP

curriculum is the most adopted AP CSP curriculum in the United States.⁶ Code.org has worked with dozens of states, hundreds of school districts and thousands of schools to create K-12 CS initiatives.⁷ More than 30 million students and a million teachers have used Code.org's *open source* curriculum and platform.⁸ Code.org's model, focused on supporting in-service teachers who are new to CS, has provided professional learning to 86,000 CS teachers across grades K-12 since 2014. Code.org has created a network of 64 Regional Partners and 500+ facilitators to provide this training. Code.org's Regional Partners⁹ consist of educational service agencies, nonprofits and universities across the country, and serve as regional hubs of computer science education. As a hub, Regional Partners 1) work with local districts and schools to expand CS programs, 2) host professional learning programs for K-12 teachers with experienced Code.org-trained facilitators, and 3) provide opportunities for teachers to join and help grow a local community of CS educators.

(a) Significance

(1) The proposed project contributes to increased knowledge or understanding of educational problems, issues, or effective strategies

Equity in AP CSP will focus on expanding access to AP Computer Science Principles (AP CSP) in high school. AP CSP is the newest AP course, launched in 2016-17, and was developed by the College Board and the National Science Foundation to respond to the growing crisis of under enrollment and underproduction of degrees in computer science, coupled with insufficient representation by women and URMs (Astrachan et al., 2010). Even with this new course, equity in AP CS remains a significant challenge. While the number of women and URM students taking AP CS has recently grown substantially, in the first two years of AP CSP's existence only 32% of AP CSP exam takers were female and only 27% were underrepresented minority students.¹⁰

More generally, access to any CS course work in US schools remains a significant issue. Only 35% of high schools teach CS,¹¹ and rural, low-income, and high minority schools have less access.¹² Further, we know we cannot depend on the pre-service teacher pipeline to expand access in the short term. In 2017 only 35 teachers graduated college prepared to teach K-12 computer science, compared to over 11,000 math teachers and almost 12,000 science teachers prepared.¹³ Thus, Equity in AP CSP focuses on schools, and their administrators, counselors and in-service teachers to address this equity and access problem.

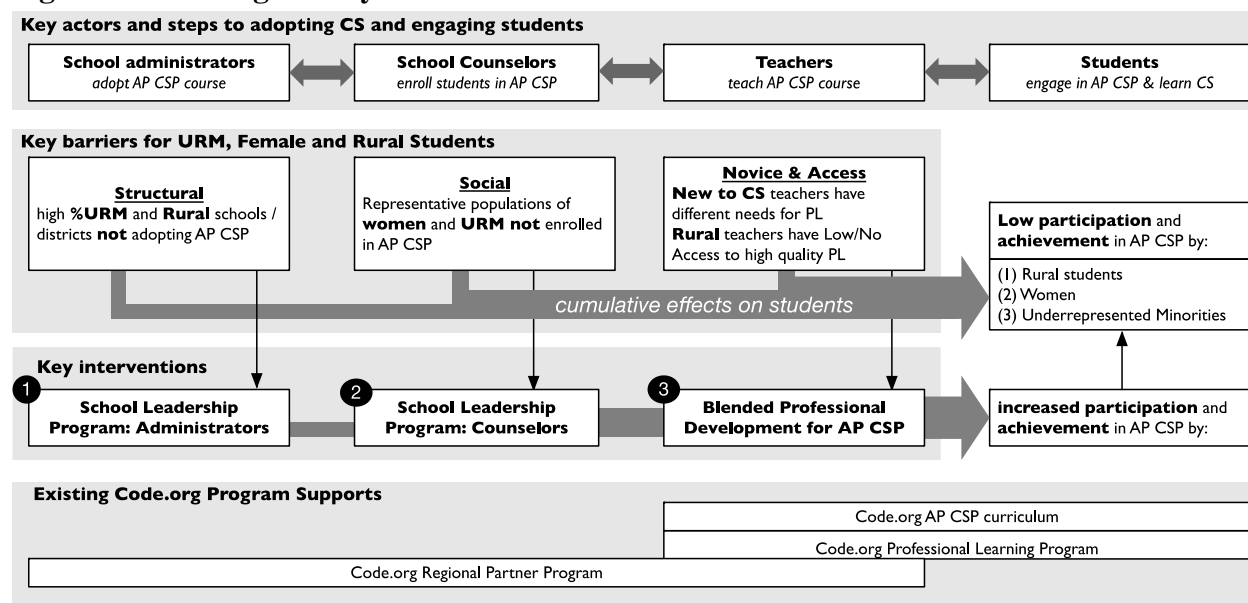
The Equity in AP CSP project seeks to augment Code.org's systemic approach to expanding CS education in the US, with interventions that are targeted to breakdown key barriers to participation by women, URM and rural students and thereby improve the CS learning outcomes for these student populations.

The key barriers addressed by Equity in AP CSP are **Barrier 1:** supporting new-to-CS teachers requires different approaches than traditional STEM professional learning (where professional learning is already established in pre-service teacher programs, school curriculum and culture (Willie, S. et. al., 2017), **Barrier 2:** rural students and their teachers do not have the same kind of access to CS curriculum, supports, and resources as their urban and suburban counterparts,¹⁴ **Barrier 3:** administrators often do not have a comprehensive understanding of what CS is, how learning it might benefit their students, or what high-quality CS instruction looks like, resulting in low “buy-in” and thus lower rates of adding CS courses into their master schedules (Margolis, 2010) and (Willie, S. et. al., 2017), and **Barrier 4:** counselors and other school staff that support student enrollment also lack understanding of CS and often advise students based on misconceptions and stereotypes about what CS is and who it's for, reinforcing

a divide that keeps underrepresented students (women and URM) out of CS courses (Margolis, 2010). These barriers are described in detail in Attachment I-2.

Equity in AP CSP recognizes that *single interventions alone cannot transform our schools*. The lack of participation by women, URM, and rural students in AP CSP cannot be attributed to just one factor, nor can a single solution fully address these barriers that impact different parts of the education system. In short, there exists a systemically embedded series of beliefs and decisions made through the school system by administrators, counselors, teachers and even students themselves that have a **cumulative effect** of “de-tracking” students, especially women and URM, away from CS courses (Margolis, 2010). Thus, to provide equitable opportunity and achievement in CS for all students, Equity in AP CSP will develop a system of multiple interventions to ensure that once a school adopts a CS class, key strategies are employed to eliminate each potential barrier to a student enrolling in a CS class and succeeding.

Figure 1: Code.org Theory of Action



For example, administrators and counselors that support CS education alone will not be enough without providing the new-to-CS teachers in their schools access to high-quality professional

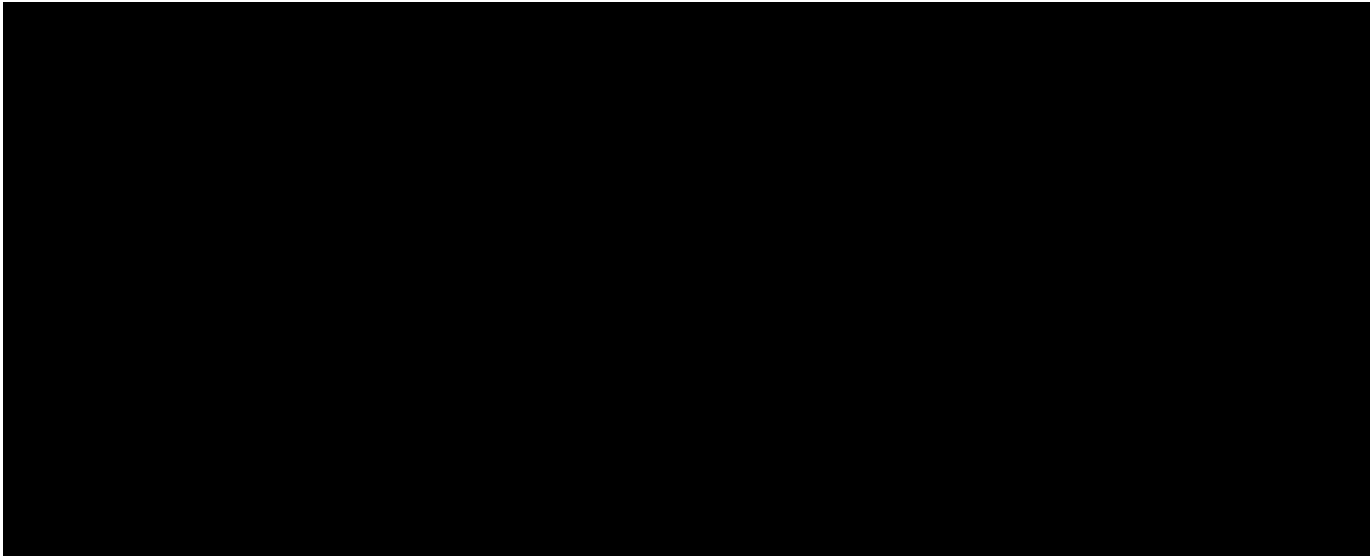
learning. Similarly, a well-trained new-to-CS teacher alone will not be able to build a school culture that supports CS and encourages equitable access to the course.

Code.org’s current model for scaling and expanding CS education has already begun to address these challenges, as demonstrated by the impact of the Code.org program on AP CSP test taking and qualifying scores from Brown & Brown (2019). What Code.org has ***not*** been able to sufficiently address to date, and therefore what this proposal seeks to address is 1) the need for more robust resources and structured guidance for administrators and counselors at the school and district level that lead to student enrollment and engagement in CS courses and 2) the need to make high-quality¹⁵ professional learning for teachers more accessible, particularly to those from rural communities. Equity in AP CSP will specifically target each of the barriers listed above by integrating the proposed School Leadership and Blended PL Programs into the existing Code.org Professional Learning and Regional Partner Programs to understand if this approach can collectively improve student outcomes for women, URM and rural student populations. This will, in turn, inform the broader CS and education communities that are also working to bring high-quality CS instruction into schools and facing these same barriers.

(2) The proposed project involves the development or demonstration of promising new strategies that build on, or are alternatives to, existing strategies

Equity in AP CSP builds on Code.org’s successful AP CS Principles Program, which begins with Regional Partners **recruiting schools and teachers**. Then, supported by Code.org Facilitators (who receive a separate, year-long Code.org training), Partners host a **year-long professional learning experience for teachers**, which supports teachers throughout the academic school year as they use the **Code.org AP CSP curriculum** with their students.

Recruiting schools and teachers: Equity in AP CSP’s School Leadership Program builds on the evidence from school leadership research that only classroom instruction has a greater impact on student learning than school leadership (Leithwood, et. al., (2004) as cited in Loucks-Horsely, (2009)), and that principals can employ concrete strategies to support reform and set cultural conditions in the school for teaching and learning to thrive. Those strategies identified by Banilower et. al. (2006) such as active participation in professional development, supporting teacher leaders, and creating structures for teacher collaboration, are key elements in the School Leadership Program. This program will augment Code.org’s current Regional Partner school recruitment and outreach successes. In the existing model teachers applying to Code.org’s Professional Learning Programs must demonstrate that their school principal is committing to 1) sending them to their Regional Partners’ Professional Learning Program and 2) including the course in the school’s master schedule. While Regional Partners have had success adapting existing resources for the schools in their area as demonstrated by the impact numbers below, the School Leadership Program will allow the specific barriers faced by school administrators and counselors who have not yet adopted CS courses to be better addressed.



Professional learning experience for teachers: A study published by Brown & Brown (2019) shows early evidence of the effectiveness of Code.org’s AP CSP program. The study employed a potential outcomes modeling approach to estimate the effect of Code.org’s Professional Learning Program on Advanced Placement (AP) Computer Science Principles test taking and qualifying score earning for a cohort of 167 schools compared to a matched group of comparison schools for the 2016-17 school year. **Results showed significant increases in student outcomes, specifically, AP CSP test taking and qualifying score earning,** summarized in Figure 3. These results are even more impressive given that 50-60% of a typical cohort of teachers in Code.org’s AP CSP program are completely new to teaching CS and 75-85% are within their first five years of teaching CS.¹⁷

Figure 3: Code.org Impact Summary

<i>Causal Estimates of AP CS Principles Test Participation and Qualifying Score Earning (Brown & Brown, 2019)</i>		
	Additional tests taken per school (167 schools)	Additional Qualifying scores earned
All Students	16.27	10.41
Female Students	5.0	2.68
Black + Hispanic ¹⁸	6.38	2.65

A key element of the AP CSP program studied by Brown & Brown are the ongoing academic year workshops, which provide *collaborative* and *classroom-focused* opportunities for teachers to experience and teach the lessons coming up in the curriculum a few months in advance. This is crucial for teachers who are new to CS for both just-in-time content acquisition, and continued hands-on practice with teaching strategies unique to CS such as Pair Programming and Debugging. This model for ongoing academic year workshops adheres to criteria for high-quality professional development outlined in the Every Student Succeed Act (ESSA) (Figure 7) and is one of the key ways Code.org provides *sustained, job-embedded* supports. The Blended PL Program will maintain these qualities in its online version of the academic year workshops.

Curriculum: Code.org’s open source AP CSP curriculum is designed specifically with the new-to-CS teacher in mind with built-in supports that include a curriculum guide, daily lesson plans, a teacher and student learning dashboard to monitor progress and access to an active community of peers and mentors through online forums. The curriculum itself is designed for student engagement with equitable, inquiry-based teaching and learning strategies. A hallmark of the curriculum design is to not advantage students who enter the course with prior knowledge of CS as that has been shown to cause students in underrepresented groups to disengage due to stereotype threat. (Margolis, 2011). For example in Unit 1, Lesson 2¹⁹ students are asked to build a device out of normal household materials that can communicate one of two possible messages to a partner on the other side of the room. *Any student can do this and any teacher, even a new-to-CS teachers can teach it.* The teacher addresses small working groups with prompts that encourage students to continually improve their devices. The lesson goes on to introduce fundamental CS concepts (digital communication and encoding of information) as well as vocabulary (protocol, binary, bit, etc), but only *after* a classroom of students have had this common, highly engaging experience. Students arrive with vastly differing amounts of prior knowledge and expectations about what a computer science course is, who belongs in it, and who can succeed. Code.org curriculum makes conscientious efforts to ensure that stereotypes that threaten student engagement are discredited and engagement from all students occurs within each class learning experience. Attachment I-4 describes Code.org’s Curriculum and Values in detail.

(b) Quality of the Project Design

(1) The extent to which the goals, objectives, and outcomes to be achieved by the proposed project are clearly specified and measurable.

Equity in AP CSP seeks to improve college readiness in women, URM and rural student populations in AK, ID, KY, TX (Austin) and WV, by seeing increased numbers and percentage of students at a school enrolling in AP CSP and earning qualifying scores. The main goals, activities and outcomes are outlined below and in the Code.org Logic Model, Attachment G.

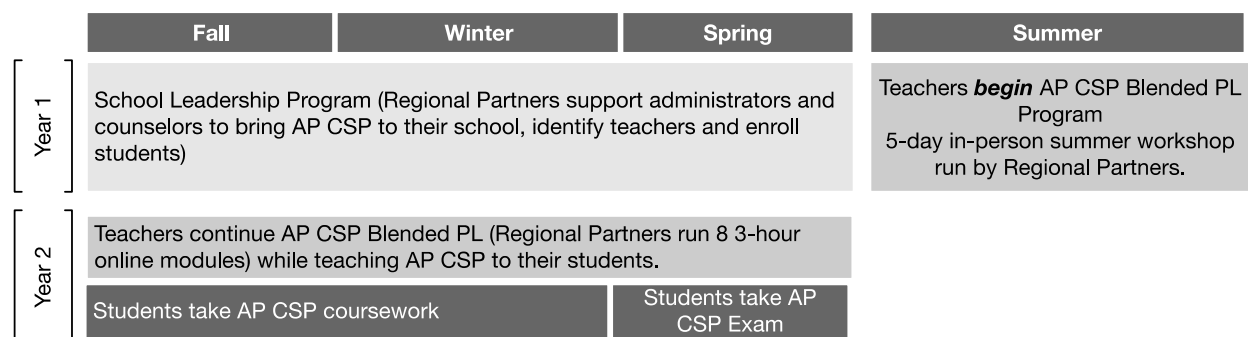
Figure 4: Program Goals, Activities, and Outcomes

Goal 1: Train new AP CSP teachers.
Activities: 100 high school teachers each year will successfully complete the Blended PL Program (20 in each Partner region).
Outcomes: Greater # and % of teachers report increased knowledge of CS and confidence in ability to teach AP CSP, especially those new to computer science.
Goal 2: Increase AP CSP enrollment from baseline year in the following student populations: women, URM and rural.
Activities: 100 high school counselors each year will use the resources provided in the School Leadership Program (20 high school counselors in each Partner region). Counselors will utilize resources to understand barriers to student enrollment and will leverage equitable recruiting strategies.
Outcomes: 1) Greater # and % of women, URM and rural students taking AP CSP, and 2) Greater # and % of women, URM and rural earning qualifying scores on AP CSP.
Goal 3: Increase the number of schools adding AP CSP into their master school schedules.
Activities: 100 high school administrators each year will use the resources provided in the School Leadership Program, (20 high school administrators in each Partner region). Administrators will utilize resources to adopt a rationale for CS at their school then implement an action plan that uses strategies to equitably build a CS program at their school
Outcomes: Greater # and % of schools offer AP CSP.

Equity in AP CSP's influence on more distal outcomes, like teacher engagement in the CS community and school culture and climate shifts as more students enroll in AP courses, will also be explored. For example, deeply engaged teachers may teach additional CS courses, apply to be a Code.org facilitator, and/or join the local Computer Science Teacher Association (CSTA) chapter. Over time, Equity in AP CSP is also interested in exploring if increased enrollment in AP CSP creates a more representative population of students enrolled in a school's CS courses overall.

Equity in AP CSP interventions will occur over a 22-month cycle, beginning with the School Leadership Program each fall and the Blended PL Program beginning each following summer.

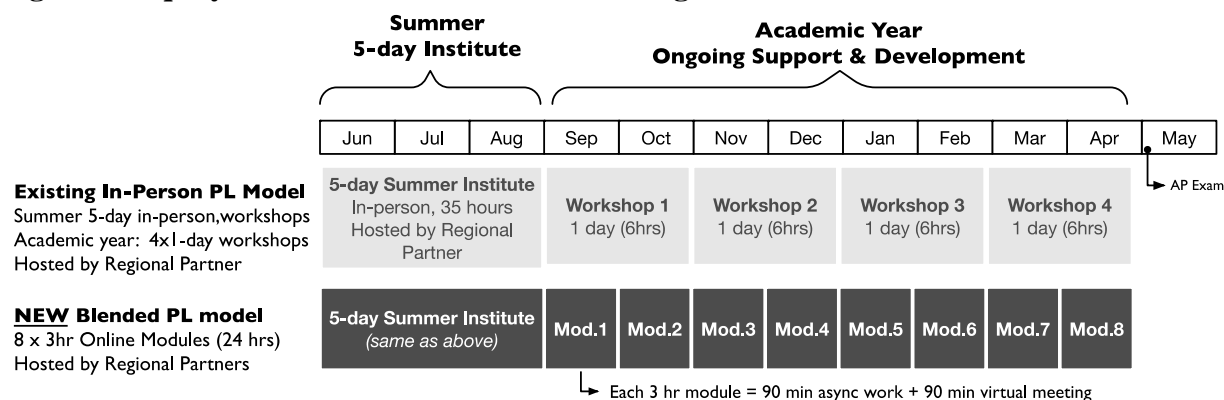
Figure 5: Equity in AP CSP Program 22-Month Implementation Cycle



There will be one trial of the Blended PL Program to test the online components during the 19-20 year, followed by a pilot of the full (summer in-person + academic year online) Blended PL Program. There will also be a pilot of the School Leadership Program in the fall of 2019 to test delivery methods and refine content. Following this, there will be three full cohorts, which will reach 100 teachers, 100 administrators and 100 counselors each year (20 from each group, in the 5 Partner regions each year).

Teacher Professional Learning: The current Code.org Professional Learning Program begins with a 5-day in-person summer institute followed by 24 hours of in-person professional learning, typically as four 1-day workshops spaced throughout the academic year.

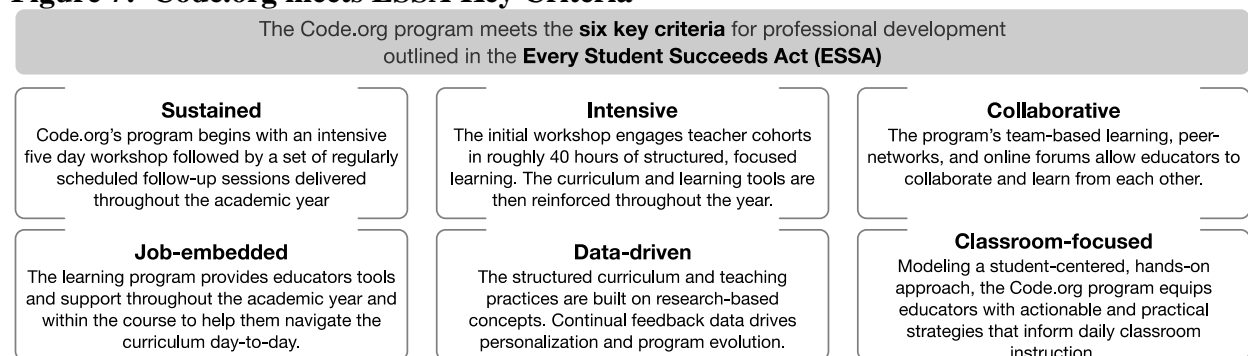
Figure 6: Equity in AP CSP Professional Learning Model



The 5-day institute provides a strong foundation of content, pedagogy and community building, in order for teachers to begin teaching AP CSP in the fall. The academic year

workshops provide teachers with additional training and just-in-time support for learning lessons and course content that are coming in the near future, as well as AP exam and Performance Task review and practice²⁰. Currently the academic year workshops in the traditional Code.org model present the biggest access barrier for rural teachers trying to complete the professional learning program (due to long travel times needed to attend a full-day workshop). However, because they are a crucial aspect to ensuring the program meets the Every Student Succeeds Act (ESSA) guidelines for professional development (see Figure 7), the proposed Blended PL Program will replace the in-person academic year workshops with eight, 3-hour online modules. The content of the Blended PL Program will be largely the same as the in-person model, but with different modalities of engagement to take advantage of a combination of synchronous and asynchronous activities that are possible online. Supported by Code.org facilitators, the Blended PL Program will, for example, replace individual lesson study that would happen during a quiet reading period in the in-person program, with an assignment for teachers to spend the same number of minutes asynchronously studying upcoming lessons and content. Then, when teachers come together in a synchronous web-based video meeting, the Blended PL Program will leverage online virtual meeting tools to host breakout small group discussions and then engage in collaboration and conversations synchronously.

Figure 7: Code.org meets ESSA Key Criteria



(Combs and Silverman (2016), ESSA Act (1965))

(2) Conceptual framework underlies project and is high quality

Equity in AP CSP project's framework addresses each of the complex and overlapping barriers described in this proposal. The Logic Model demonstrates how Equity in AP CSP connects student, teacher and school inputs and activities with powerful and measurable short and long term outcomes.

Research Foundation for the School Leadership Program (Administrators and Counselors): The framework for the School Leadership Program builds on the work of Wang et. al, (2017), Rhoton (2018), Margolis (2010), and Willie et. al. (2017) who suggest capacity building for school administrators should (a) increase their knowledge about CS courses to understand the utility of learning CS and benefits for all students, even those perceived to be “low performers” and (b) develop strategies for adding a CS course to the master schedule, and implementing a high quality program with fidelity. Furthermore, as suggested by Wang, Margolis and Hug (2013), a capacity building program for in-school counselors should (a) increase their knowledge about what a computer science class is, (b) understand the systemic and cultural barriers that prevent students, especially URM and women, from taking computer science as well as the counselor's role in overcoming those barriers, (c) show that all types of students can succeed even if AP CS Principles is their first CS course, and (d) develop strategies for enrolling those students (Hug, et.al., 2013).

Based on this research, the School Leadership Program will build two unique sets of resources with 4-6 hours of content: one set uniquely designed for school administrators to help them navigate the process of offering the course and adding to the master schedule, and one set designed for counselors, to help them effectively advise students once the course is on the

school's master schedule. Equity in AP CSP will train Regional Partners to adapt the resources for their local context. When looking at supporting rural administrators and counselors, building 1:1 relationships are key as "rural districts and schools offer considerable variation in terms of geography, resources, economy, culture, and racial and ethnic makeup" (Fox et. al., 2017). Therefore, the School Leadership Program will include flexible delivery options, such as 1:1 or small group meetings between Partners and administrators that are in person or online that will allow Regional Partners to better "acknowledge and seek to understand the individuality and uniqueness of each school and its rural community context" (Fox et. al., 2017). Activities will be designed to ensure that both administrators and counselors leave with a comprehensive understanding of what CS is. Specifically, administrators will be able to 1) adopt a rationale for CS education at their school, 2) be able to set goals for student outcomes (including participation by underrepresented groups) and define how to measure these outcomes, 3) understand what high quality CS instruction looks like, 4) build an action plan that makes best use of Code.org programs that can help reduce school-based barriers to implementation and 5) be able to implement strategies to equitably build a CS program. Counselors will be able to 1) understand how a CS education program can encourage/enable equitable participation, and 2) build an action plan that includes concrete strategies for overcoming student barriers to enrolling in CS courses. Attachment I - 3 outlines further details on the types of activities, outcomes and program delivery options.

Research Foundation for the Blended PL Program (Teachers): The framework for the Blended PL Program builds on early research in blended learning (Clark, 2012; p. 181), which concludes that the *quality of the curriculum* and *effective instructional methods* for delivering the content matters more than the modality of engagement. Code.org's existing in-person program,

and the proposed Blended PL Program includes the novel use of coordinated asynchronous and synchronous modalities for engagement, which increases the level of individualization, flexibility, and responsiveness of the program, which (Amaka, 2017) suggests is tied to effective delivery of content.

Research Foundation for Student Outcomes: College Readiness: Taking any AP course leads to long-term positive outcomes for college readiness and graduation, regardless of score on exam (Jackson, C.K. 2014). Furthermore, (Banilower, E., et al, 2018) also shows there is a greater AP access issue for rural schools, specifically that "large schools are more likely to offer AP computer science courses than small schools. Rural schools are less likely than suburban or urban schools, and high-poverty schools less likely than low-poverty schools, to offer AP computer science (see Table 4.24). Additionally, (Brown & Brown, 2019) shows early evidence of the effectiveness of Code.org's AP CSP program where treatment schools showed significant increases in AP CSP test taking and qualifying score earning. Taken together, Equity in AP CSP expects the proposed Blended PL Program will result in the same student outcomes as the traditional Code.org professional development found to be effective in the Brown study, as well as result in an increased college readiness in women, URM and rural students, as demonstrated by a greater number and percentage of them taking AP CS Principles exams and earning qualifying scores.

(3) Extent to which performance feedback and continuous improvement are integral to the design of the proposed project

American Institutes for Research (AIR) will serve as the independent evaluator for the Equity in AP CSP Project. Evaluation activities will begin early with AIR studying a pilot cohort of 8 schools in 2019-20, selected out of the 100 schools reached that year. Evaluation will continue

with the first full cohort, which will begin with administrators starting in the fall of 2020, through to the students taking the exam in the spring of 2022 and will follow those teachers for 3 years. The performance feedback that AIR will collect will be used to improve the additional cohorts of administrators, counselors and teachers served in this project. In addition, Code.org will continue with existing internal methods for collecting feedback and continuous improvement, which includes student progress data from the learning platform, teacher and student surveys, annual reporting and reviews with Regional Partners, and monthly check-ins between Partners and their dedicated Code.org staff member.

(c) Adequacy of Resources and Quality of the Management Plan

(1) Management plan will achieve the stated objectives on time and within budget with clearly defined responsibilities, timelines, and milestones

The following table outlines the key activities and milestones necessary to achieve the stated objectives on time and within budget. Code.org has strong working relationships with the Idaho Digital Learning Academy, The Center for STEM Education at the University of Texas at Austin, Kentucky Science and Technology Corporation, West Virginia University, and the Alaska Staff Development Network. The project staff described below, as well as the grants compliance team, already work together extensively to run Code.org's programs. In addition, project staff and AIR will work closely together in the planning year to establish clear processes and procedures to achieve the objectives of this project. The key activities and milestones are:

Activities and Milestones	Responsible Party	Year and Month(s)				
		YR 1 (19-20)	YR 2 (20-21)	YR 3 (21-22)	YR 4 (22-23)	YR 5 (23-24)
Prepare for implementation: Hire positions needed and meet with evaluator	Code.org	X				
Blended PL Program Development of program and materials.	Code.org	X				

School Leadership Program Development of program and materials.	Code.org	X				
Ongoing improvements of Blended PL and School Leadership Programs	Code.org	X	X	X	X	
Initial training for Regional Partners and staff to run Blended PL and School Leadership Programs	Code.org/ Regional Partners	X				
Annual Meeting for Regional Partners, Facilitators and Code.org staff (training, review of program improvements, ongoing support)	Code.org / Regional Partners	X	X	X	X	
Use School Leadership Program materials to recruit participating schools (annually)	Regional Partners	X	X	X	X	
Deliver School Leadership Program to participating administrators and counselors (annually)	Regional Partners	X	X	X	X	
Contract with Code.org trained facilitators to run blended teacher PD (annually)	Regional Partners	X	X	X	X	X
Deliver Blended PL Program to recruited teachers (annually)	Regional Partners	X	X	X	X	X
Confirm data-sharing agreements and execute contracts with each participating schools (annually)	Regional Partners	X	X	X	X	
Collect annual feedback from students, teachers, administrators, and staff to inform continuous improvement	AIR	X	X	X	X	X
Student scores received; verification of schools and participation confirmed	AIR		X	X	X	X
Agree upon annual participation and performance goals for teachers, students, and schools	AIR	X	X	X	X	
Develop comprehensive evaluation plan and management plan for submission to the Department of Education	AIR	X				
Make semi-annual updates to program to reflect feedback from key stakeholders, Partners, and participants	AIR	X	X	X	X	
Finalize data analyses	AIR					X
General Grant Oversight and Compliance Reviews (ongoing, both monthly, annually and as needed)*	Code.org	X	X	X	X	X
Code.org Staff/AIR - Dissemination of Research	Code.org/ AIR					X

(2) Qualifications of key personnel

Code.org will pull together a cross-team group of qualified individuals from across the organization to implement the project that has content expertise as well as experience managing large, complex projects. Key personnel follow (detailed resumes in Attachment B).

Figure 8: Key Personnel Roles and Relevant Experience

Project Director Cameron Wilson, COO	Responsible for meeting project deliverables and meeting implementation goals.	Worked with Code.org's CEO, Hadi Partovi, to lead Code.org's scaling strategy for K-12 CS resulting in more than 30 million students and 1 million teachers trying the Code.org platform, as well as 48 states that have changed policies supporting K-12 CS.
Director of Outreach Carina Box	Responsible for working with Regional Partners, supporting school and teacher recruitment activities and supervising day-to-day grant activities.	Has grown Code.org's national and international partnership teams, who currently manage 60+ Partners in the United States and 50+ Partners globally.
Education Program Manager Brook Osborne	Oversee the development of Equity in AP CSP professional learning curriculum and training activities.	Developed Code.org's PL models for teachers and facilitators and run programs to prepare over 4,000 teachers and 500 Code.org facilitators.
Data and Evaluation Manager Baker Franke	Coordinate with project's independent evaluator and support internal data collection.	Developed Code.org's CSP curriculum and managed multiple research partnerships around its educational programs, including the study by Brown & Brown, 2019 about the AP CSP Program.

Alex Brenner, Director of Accounting and Finance will lead the Grants Compliance Team for Equity in AP CSP. Alex currently manages the budgeting process, provides audit compliance and legal support and manages cash flow, investment and long-term financial planning for Code.org, an organization with an annual [REDACTED]. David Bernier, Fundraising Manager, who manages relationships and reporting for 25 corporate and foundation donors (multiple multi-million dollar donations each year) will provide compliance support. Nimisha Mondal, Strategic Development Manager, who currently supports the development of a long-term sustainability strategy for Code.org's 64 Regional Partners will also provide grant compliance oversight and guidance throughout the project.

In addition to Code.org staff, the team will also include representatives from the five participating Regional Partners. These Partners, selected out of the existing cohort of 64 Partners, bring a diverse set of experiences, a proven track record of delivering professional learning programs and partnering with districts, and a clear demonstrated need for online professional learning and flexible delivery methods for supporting school leadership as proposed in this project (support letters provided by 10 districts in Attachment C). Selected to provide diverse

environments to test the interventions, they represent large states where travel for academic year workshops is demonstrably prohibitive (Alaska, Idaho), regions where online professional learning and flexible delivery methods could expand the geographic reach of the programs (Austin, TX), and regions where it is possible, but challenging, to bring small groups of teachers together and therefore online professional learning and flexible delivery methods could provide a critical alternative (West Virginia, Kentucky). These partners are already leaders in their states for online program delivery (Alaska and Idaho) or show promise in their track records for becoming such a leader in their state (Kentucky, West Virginia and Austin, TX).

(3) Continued support after the grant period

Code.org currently is working with all 64 Regional Partners to build out long term sustainability funding, which includes exploring different opportunities, including but not limited to state funding, private/philanthropic donations and fee-for-service models (where schools/districts fund programs, supported by existing school/district budgets). Code.org will continue to work with participating Regional Partners to ensure ongoing, sustainable funding resources are being identified and utilized. [REDACTED]

[REDACTED]

[REDACTED] As a result of the grant activities, impacted schools (500 over the course of 5 years) will have established a school culture that supports and sustains computer science education. Additionally, Code.org intends to incorporate successful elements of Equity in AP CSP into its national strategy and programs.

(d) Quality of the Project Evaluation

The American Institutes for Research (AIR) will work with Code.org to conduct a rigorous evaluation of Equity in AP CSP. The evaluation will provide Code.org with the timely and

actionable formative feedback essential for ongoing monitoring and improvement of program implementation during the implementation phase of the intervention. It will also produce evidence about Equity in AP CSP’s effectiveness that will meet the What Works Clearinghouse (WWC) Design Standards with reservations, and will provide guidance about effective strategies for replication and testing in future settings.

Design Overview and Research Questions. To address the research questions in Figure 9, AIR will conduct a mixed-methods implementation and outcomes study drawing on multiple data sources: surveys, interviews, focus groups, documentation, and administrative data.

Figure 9: Research Questions

Research questions	Goals	Data sources
Implementation Evaluation		
I1. To what extent is Equity in AP CSP being implemented with fidelity across partner schools, and how does implementation fidelity vary across schools and across program goals?	1, 2, 3	Baseline practices survey Barriers And Supports in Implementing Computer Science (BASICS) survey Document analysis Observation protocol
I2. How is Equity in AP CSP integrated into and coordinated with existing programs and aligned with school policies and practices?	3	Baseline practices survey Interviews and focus groups
I3. Does Equity in AP CSP’s program model lead to changes in practice for all those trained (i.e., teachers, administrators, and counselors)? If so, what changes occur?	1, 2,3	Baseline practices survey BASICS survey Interviews and focus groups
I4. What are the financial and social resources needed to implement Equity in AP CSP, and to what extent is implementation sustainable for the school?	1, 2, 3	Document analysis Interviews and focus groups
Outcomes Evaluation		
O1. Does AP Computer Science Principles (CSP) teachers’ engagement in computer science increase in schools implementing the Equity in AP CSP program?	1	Document analysis
O2. Does the Equity in AP CSP program increase the representativeness of student demographics in AP CSP specifically, and in advanced coursework more generally?	1, 2, 3	Document analysis
O3. What is the effect of Equity in AP CSP on students’ likelihood of (a) taking the AP CSP exam and (b) earning a qualifying AP CSP exam score?	2, 3	Administrative data
O4. Are the effects of Equity in AP CSP on student outcomes moderated by student and school characteristics?	1, 2, 3	Administrative data

Implementation Study. AIR will conduct an implementation study using replicable and sustainable methods, enabling Code.org and its Partners to use and adapt these methods efficiently to measure fidelity and monitor implementation throughout and beyond the grant period. Code.org will implement the program with a pilot cohort of approximately 100 schools in the 2019–20 school year, of which eight schools will serve as a pilot group. Equity in AP CSP will be implemented in approximately 100 schools in the 2020-21 school year, with 21 of these schools specified for the treatment group. The purpose of the pilot study is to gain an early understanding of the factors that both help and hinder implementation fidelity, which will be used to inform implementation of the treatment cohort. Subsequently, the purpose of the implementation study is to provide a rich description of the implementation of the Equity in AP CSP model, add important context to the impact estimates, and provide formative feedback to the project team to support continuous improvement through program implementation.

Data Sources and Analysis. To measure baseline school resources and practices regarding computer science and advanced course-taking school culture, AIR will design and administer a systemwide *baseline practices survey* aligned with the planned rollout of the intervention to school principals in fall 2020, school counselors in winter 2021, and teachers in spring 2021. The baseline survey will provide information on the services, supports, and strategies that participating schools have in place before Equity in AP CSP implementation that may reflect a computer science–focused culture. This will establish a baseline from which to measure the implementation of Equity in AP CSP and the extent to which it transforms each partner school.

To gauge perceptions of Equity in AP CSP implementation, challenges, strengths, and overall program utility, AIR will adapt the Barriers and Supports to Implementing Computer Science (BASICS) survey (Outlier Research & Evaluation, 2017) and administer it to teachers

and students during spring 2022, spring 2023, and spring 2024.²¹ The survey was developed to measure key supports and barriers to implementation of an introductory computer science course and is highly adaptable for measuring the implementation of AP CSP in schools. The survey includes primarily fixed-response items with Likert-type response scales (e.g., agreement scales, frequency scales). The structure of the response items will enable us to calculate fidelity of implementation scores based on a priori benchmarks for each school that will be determined in partnership with Code.org during the initial planning phase of the project. More detail regarding key implementation constructs is presented in Attachment I-5. AIR will present descriptive analyses of the survey responses to Equity in AP CSP annually through interim reporting in the fall, which will provide Code.org with timely feedback on implementation progress and identify program strengths and challenges to enable ongoing refinement of the program model.

To supplement data collected through the survey, we will conduct in-person 60-minute interviews during the pilot year (with staff from the eight pilot schools, spring 2020) and with members of the Code.org Regional Partners and School Leadership Teams (a total of five Regional Partners, 21 principals, 21 counselors, and 21 teachers across the 21 treatment schools), in spring 2021 during Equity in AP CSP professional development implementation, and in spring 2023 during the second year of AP CSP implementation in the schools. We will also conduct 90-minute focus groups with parents and students in five of the 21 treatment schools during spring 2022 and spring 2024 (See Attachment I-5, Table 1 for a detailed timeline of these data collection activities). Interviews and focus groups will permit more detailed responses than a fixed-response survey and enable us to probe individuals' perceptions of implementation and utility. To ensure that a diversity of perspectives is captured, we will purposely sample focus group participants to represent students' backgrounds. Interviews and focus groups will be

recorded with permission and transcribed to ensure accuracy. To contextualize the descriptive survey results, AIR will share preliminary findings related to key themes from interviews and focus groups with Code.org in an annual fall interim report.

In each pilot and treatment school, systems will be established to collect documentation of the implementation of all Equity in AP CSP components for *systematic document analysis*, including data from Code.org’s online platform, and from the development of an *observation protocol*. For example, each of the eight virtual trainings will be recorded, observed, and coded; a written synopsis of the intended content and focus, a roster of those in attendance, and evaluations of the training by those in attendance. Data collected from the pilot study will be analyzed and reported to Code.org to inform implementation for the treatment group. In addition, through the annual interim report and regular project meetings, AIR will provide timely information on whether Equity in AP CSP is meeting its attendance and participation goals and whether teachers find the training to be beneficial. This will enable Code.org to identify opportunities to further tailor its approach to service provision in each partner district. Each of these data sources is described in greater detail in Attachment I-5, Table 2. Additional detail about the data analysis methods that AIR will employ are described in Attachment I-5.

Outcomes Study. AIR will employ two designs to answer research questions on the outcomes associated with and influenced by Equity in AP CSP. To answer Research Questions (RQs) O1 and O2, AIR will conduct descriptive pre-post analyses in which outcomes will be measured once before implementation and repeatedly over the 4 years of implementation to determine whether and to what degree outcomes improve over time. To answer RQs O3 and O4, AIR will conduct a quasi-experimental design with a matched comparison group to meet What Works Clearinghouse (WWC) standards with reservations.

Descriptive Pre-Post Analyses. To answer RQs O1 and O2, we propose to draw on *systematic document reviews*. To measure computer science engagement, AIR will obtain documentation from Code.org on several teacher activities, including seeking out additional Computer Science professional development after participating in Equity in AP CSP, modifying the Code.org curriculum to better suit the needs of students, and participating in a community of practice. These activities will be measured each spring of the grant period. AIR also will draw on school *documentation* to measure school-level student demographic distributions and AP CSP classroom-level student demographic distributions over the course of the 2020–21 through 2023–24 school years. Each of these data sources is described in further detail in Attachment I-5.

For all descriptive outcomes, measures from the 2020–21 school year will serve as a preintervention measure, while 2021–22 through 2023–24 measure implementation years 2–4, respectively. AIR will descriptively analyze the extent to which outcome measures change between the preintervention period and each implementation year, as well as how measures change between postintervention years, to examine whether outcomes improve over the course of the grant period and explore how they vary across schools, states, and context.

Quasi-Experimental Analysis With Matched Comparisons. To answer RQs O3 and O4 on the impact of Equity in AP CSP on students’ likelihood of participating in and earning a qualifying exam score in AP CSP, AIR will conduct a quasi-experimental analysis with a matched comparison group. The treatment group will be composed of students enrolled in AP CSP within the 21 schools implementing Equity in AP CSP during the 2020–21 through 2023–24 school years. The comparison group will be composed of students within similar schools chosen through a 2:1 school-level propensity score matching (Rubin, 1997). To construct the comparison group, we will match Equity in AP CSP schools to two other schools with similar

pre-intervention demographic features, including location²², urbanicity, demographic makeup, and size, as well as preintervention demographic and achievement measures, to create an equivalent group of students that supports a design that meets WWC standards with reservations.

For this analysis, AIR will request extant student-level educational *administrative data* from the states of Alaska, Idaho, Texas, Kentucky, and West Virginia, and from the College Board. Outcome and covariate data will be collected for the 2019–20 through 2023–24 school years. AIR will then use a quasi-experimental design to measure the impact of Equity in AP CSP on student outcomes. The effect of Equity in AP CSP will be estimated by comparing outcomes of students in Equity in AP CSP schools with outcomes of students in the propensity score-matched group of comparison schools. This approach draws on information from both the treatment and comparison students to estimate what performance in Equity in AP CSP schools would have been if the intervention had not been implemented. The deviation from this prediction is the estimated treatment effect of Equity in AP CSP. This methodology is appropriate for contexts in which an abrupt policy or program change occurs—such as schools implementing Equity in AP CSP—and in which random assignment of students or schools to treatment groups is not feasible (See Attachment I for further detail). Furthermore, comparison to students in treatment schools in schools subject to similar local conditions and state policies reduces the likelihood that other policies or events over the same period explain any observed effects of the intervention. Additional detail about the matching procedures and quasi-experimental design can be found in Attachment I-5. We will be powered to detect a minimum effect size of .206 to .315, depending on outcome and assumptions (see Attachment I-5 for power analysis calculations).

END NOTES

¹ “Blended” means the program features both in-person and online components for participants.

² Underrepresented minorities in Computer Science are considered to be: Black, Hispanic, Native American, and Alaskan/Pacific Islander. (Google Inc. & Gallup Inc. (2016)).

³ Partner region student demographics detailed in [Attachment I-1](#).

⁴ US Dept. of Education. Applications for New Awards; Education Innovation and Research (EIR) Program—Early-Phase Grants (2019) . p. 1096. Retrieved from:

<https://www.govinfo.gov/content/pkg/FR-2019-02-01/pdf/2019-00708.pdf>

⁵ About Us | Code.org. (n.d.). Retrieved from: <https://code.org/about>

⁷ Code.org Statistics. (n.d.) Retrieved from: <https://code.org/statistics>

⁸ Ibid.

⁹ Map of Code.org Regional Partners can be found here: <https://code.org/educate/professional-learning/about-partners>

¹⁰ Dig Deeper into AP Computer Science. (2018). Retrieved from: <https://code.org/promote/ap> and College Board (2018). AP Program Participation and Performance Data 2018. Retrieved from: <https://research.collegeboard.org/programs/ap/data/participation/ap-2018>

¹¹ Code.org Advocacy Coalition & Computer Science Teachers Association (2018). *2018 State*

of Computer Science Education Policy and Implementation. Retrieved from:

https://code.org/files/2018_state_of_cs.pdf

¹² Code.org Advocacy Coalition & Computer Science Teachers Association (2018). *2018 State of Computer Science Education Policy and Implementation*. Retrieved from:

https://code.org/files/2018_state_of_cs.pdf, Pages 73, 74

¹³ Data pulled from: U.S. Dept. of Education, Title II of the Higher Education Act (2008). Data. retrieved from: <https://title2.ed.gov/Public/Home.aspx>

¹⁴ Code.org Advocacy Coalition & Computer Science Teachers Association (2018). *2018 State of Computer Science Education Policy and Implementation*. Retrieved from:

https://code.org/files/2018_state_of_cs.pdf, pp. 73-74

¹⁵ High-Quality professional learning means meeting or exceeding the six criteria for high quality professional development in ESSA.

¹⁶ Most Partners have reached additional elementary teachers as well, though not reflected in this table

¹⁷ Code.org Teacher Pre-survey data, self-reported years of experience teaching CS. See Attachment I-2.

¹⁸ Due to the low number of other underrepresented minority students, schools were matched using Black and Hispanic populations. The numbers were reported separately but were combined as a proxy for URM as Black and Hispanic students comprise the overwhelming majority of underrepresented racial minorities in Computer Science. (Brown, R. S., & Brown, E. A. (2019)).

¹⁹ Code.org's AP CSP Curriculum: Unit 1; Lesson 2: <https://curriculum.code.org/csp-18/unit2/>

²⁰ The AP CS Principles Exam consists of a 74-question multiple choice exam and two

Performance Task projects that are submitted to the College Board for review. See:

<https://apcentral.collegeboard.org/courses/ap-computer-science-principles/exam>

²¹ The BASICS survey is a psychometrically valid instrument with subscale internal consistencies between $\alpha = .75$ and $\alpha = .95$.

²² To the extent possible, the evaluation team will match treatment schools with similar schools in the same district and/or state.

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