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TABLE OF CONTENTS

INTRODUCTION

The Center for the Future of Arizona (CFA), in partnership with Jobs for the Future (JFF) and Lead Local (LL), proposes the ***Career Connected Pathways (CCP) project*** to address ***Absolute Priority 1 - Demonstrates a Rationale*** *and* ***Absolute Priority 3 - Field Initiated Innovations - Promoting STEM, With a Particular Focus on Computer Science.*** The *CCP* project addresses the urgent need to increase enrollment—particularly of high-need students—in pathways focused on preparing students for careers in STEM fields, including Computer Science and Cybersecurity (CS/Cy). Over the past half decade, the national college and career pathways movement has gained significant momentum as a successful strategy for increasing college and career readiness and increasing the number of Americans with the knowledge and skills needed for careers in STEM fields, particularly CS/Cy—fields that are vital to the U.S. economy and to our nation's global economic competitiveness. However, the success of the pathways strategy is threatened by the persistent under-enrollment of high-need students in STEM and CS/Cy pathways. *The CCP project will address this challenge by developing a new approach to college and career advising that builds on evidence-based strategies, including dual enrollment and near peer mentoring, in order to increase enrollment, persistence, and educational attainment of* ***high-need students*** *in STEM and CS/Cy pathways.*

The innovative, field-initiated *CCP* project will address critical barriers to increasing enrollment in CS/Cy pathways, particularly by high-need students, that CFA and our partners in the field have identified over five years of pathways implementation in Arizona. These barriers are: 1) lack of resources and training for teachers/counselors to provide relevant, timely information about college and career pathways information to students and families; 2) lack of alignment in advising across high schools and community colleges; and 3) need for support and motivation for students to persist in CS/Cy pathways once enrolled. In order to address the

critical need for connected, seamless career guidance and support to ensure that high-need students are entering and persisting in CS/Cy pathways, the *CCP* project will develop: 1) a *Career Connected Toolkit* consisting of resources for educators, students and parents to effectively inform and guide educational decision making with an emphasis on CS/Cy career pathways; and 2) a *Co-Advising Framework, to include a Near Peer Mentoring Model* designed to facilitate better collaboration between K12 schools and community colleges and to increase enrollment and improve persistence in dual enrollment (DE) courses.

The *CCP* project partners are all leaders in the field and provide exceptional expertise and experience to deliver on the promise of the project to increase student attainment and increase the number of students in CS/Cy pathways. The project partners will lead this work in 24 public high schools and three community college systems in Arizona. Success metrics of the *CCP* project include: 1) increased enrollment, especially by high-need students, in CS/Cy pathways; 2) increased number of DE credits earned, especially by high-need students**,** in CS/Cy; and 3) improved educational attainment rates. For purposes of this project, we define high-need students as children at risk of educational failure or in need of special assistance or support, such as children from low-income families, English learners, and foster care youth.

A. SIGNIFICANCE

The *CCP* project will create an effective strategy to address the problem of weak or non-existent college and career advising structures and strategies in K12 schools that lead to under-enrollment in the STEM and CS/Cy pathways. The *CCP* project will increase students' college and career readiness and prepare young people for careers in that are vital to our economy.

A.1. Increased knowledge or understanding of educational problems, issues, or strategies. Increasing the enrollment of students—especially high-need students—in STEM and CS/Cy pathways is critical to the strength of our national economy. One-fifth of all U.S. jobs are STEM-

related; that number is expected to grow by 16 % by 2024 (Murphy & Topel, 2016). Ninety-three % of STEM occupations offer significantly above-average wages, and half of U.S. STEM jobs require sub-baccalaureate credentials (Change the Equation, 2018). Job growth and wages are even higher in CS and information technology fields than for STEM jobs overall (Fayer et al., 2017). Like the U.S. overall, Arizona needs more young people with credentials and degrees in high-demand STEM fields, especially CS/Cy. Arizona currently has nearly 10,000 open computing jobs, and the demand rate for workers in computing occupations is 2.7 times the average demand rate across all states (Code.org, 2019). Similarly, the Arizona cybersecurity industry is facing an acute need, with over 800 unfilled openings in entry-level cybersecurity roles (Burning Glass Technologies, March 2019), and projections show that the demand for entry-level talent will continue to increase. However, in 2017, there were only 814 computer science graduates in Arizona, only 16 % of whom were female (Code.org, 2019).

These data highlight the critical national importance of building a talent pipeline in STEM-related fields, especially CS/Cy, but doing so will require a concerted effort to increase postsecondary attainment, especially for high-need students. Good jobs that offer competitive wages and benefits almost always require postsecondary education, yet U.S. college completion rates have virtually stagnated since 1980 (Bailey & Dynarski 2011). Only 42 % of U.S. adults aged 25 or older have earned an associate's degree or more (Computer and Information Technology Occupations, 2018). This gap is especially acute for people of color: only 32 % of Blacks and 23 % of Hispanics have earned an associate's degree or more (Ryan & Bauman, 2016). Arizona's postsecondary attainment rates, like those nationwide, lag behind projected labor-market needs. While 68% of jobs in Arizona will require postsecondary education by 2020, only 45% of Arizona residents have completed a 2- or 4-year degree or non-degree credential, and only 53% of Arizona's public high school graduates enroll in a postsecondary institution

immediately after graduation (Carnevale, et al., 2017). Nationally, just 17 % of all bachelor's degrees (11 % for Blacks and 14 % for Hispanics) are awarded in STEM fields (Ryan & Bauman, 2015), and interest in STEM majors is declining, especially among traditionally underrepresented groups, including women, students of color, and economically disadvantaged students. *Persistence in STEM fields is also a major obstacle, with women, minorities, and students from low-income backgrounds leaving STEM related majors at higher rates than their counterparts* (Smith et al., 2018). The consequences of this are clear, as Blacks, Hispanics, and women are all significantly underrepresented in STEM occupations (Smith et al., 2018).

These disparities begin in high school. Girls and students of color are persistently underrepresented in Arizona's STEM and CS/Cy classes and pathways. In 2018, Arizona students took a total of only 1,108 Advanced Placement exams in Computer Science. Of those exams, only 24% were taken by female students. Hispanic or Latino students took only 23% of the total number of exams taken; 2% were taken by Black students; and American Indian, Alaska Native, Native Hawaiian, and Pacific Islander students took a combined total of less than one percent of all exams (Code.org, 2019).

Arizona is an ideal location to develop and pilot the *CCP* project because the state's student demographic makeup represents the future of the U.S. as a whole. Arizona schools have served majority-minority populations for over a decade, though public schools nationwide did not reach majority-minority status until the 2014-15 school year. Statewide, Hispanic/Latino students make up the single largest demographic, at 45.3%. Arizona schools also serve large numbers of economically disadvantaged students. Statewide, 57% of students qualify for free or reduced lunch, and 13% of students receive special education services. A full 6.4% of students participate in English language learner programs, above the U.S. median for all states.

Dual enrollment STEM pathways can increase the number of students, especially high-need

students who attain postsecondary degrees and credentials and enter the labor market prepared for STEM careers, but too few students understand the promise of these pathways due to weak or nonexistent college and career advising structures in high schools. School counselors at the high school level are often tasked with providing college and career advising for students, but few counselors have access to the resources needed to do so successfully. Yet, while counselors report that providing career information and guidance is important, 45% say that other social-emotional and academic counseling responsibilities receive higher priority, 27% cite a lack of quality resources and materials as a barrier, and 20% admit to a lack of understanding on how best to support career advising (New Skills for Youth Initiative, 2018). Counselors in most schools also struggle with overwhelming work loads. Arizona's student:counselor ratio was 924:1 in 2014-15, almost twice the national average of 463:1, and nearly four times the American School Counselors Association's recommended ratio of 250:1 (American School Counselor Association). In this context, it is unsurprising that many students seek career advice from parents, friends and family members who themselves have little knowledge of the system and how to navigate complex decisions regarding education and careers. There is therefore a pressing need to develop high-quality advising resources to be deployed by counselors and teachers.

The need for high-quality college and career advising has been identified by the field, with CCP project school partners noting that all students and their families, and particularly high-need students, need additional resources, information, and support to enter and persist in CS/Cy pathways. Unfortunately, schools do not have relevant, timely career resources readily available, and most counselors and teachers do not have the capacity to develop materials or spend time learning about labor market data, availability of jobs, and aligned credentials to effectively guide students. Providing the right information, at the right time, delivered in a format fitting to the

audience, is critical to increasing interest in CS/Cy careers and subsequent enrollment in DE pathways courses in CS/Cy.

A.2. Development or demonstration of promising new strategies. The *CCP* project will develop a new strategy for college and career advising that increases student enrollment in pathways, thereby preparing more students for success in postsecondary education and in careers in the STEM fields vital to our economy. The *CCP* project is a promising, research-informed strategy that will improve student outcomes through the development of a high-quality career literacy continuum, resources, and a co-advising model—that incorporates a near peer mentoring component—in which community colleges and high schools work collaboratively to provide seamless, connected, ongoing career and college guidance.

Building on Existing Strategies.

The CCP project focuses on increasing enrollment of students, especially high-need students, in dual enrollment (DE) courses embedded within pathways. DE pathways represent an evidence-based strategy for improving a wide range of student outcomes. A 2017 What Works Clearinghouse (WWC) intervention report found that DE has positive effects on academic attainment and achievement at the secondary and postsecondary levels with a medium to large extent of evidence—and that it has no negative effects. DE is an especially important strategy for serving high-need students. In two WWC-reviewed DE studies, which met group design standards without reservations, roughly 50 % of the student samples were low-income, and between 37 and 54 % were students of color. Another study found that DE's effects were even stronger for low-income students. SRI International's evaluation of Linked Learning pathways that incorporate DE in California found that, compared with similar peers in traditional high school programs, students participating in certified Linked Learning pathways were more likely to graduate from high school, less likely to drop out, and earned, on average, more credits. *The*

CCP project responds to these findings regarding the effectiveness of DE and pathways by seeking to increase the number of students, especially high-need students, who dually enroll in courses embedded in pathways.

The *CCP* project builds upon proven, successful strategies from the national Pathways to Prosperity (PtoP) Network led by JFF and strong pathways work well underway in Arizona. Launched in 2012, the PtoP Network is a collaboration of JFF, the Harvard Graduate School of Education, and states and regions. The PtoP Network develops, implements, and scales college and career pathways to expand economic opportunity for all young people and meet regional talent needs. Arizona is an active member of the PtoP Network. In partnership with JFF and with support from the Office of the Governor and the private sector, CFA launched Arizona Pathways to Prosperity in 2014 and has worked extensively with business, higher education and K-12 to design and implement robust pathways in high-demand, high-growth sectors, including CS/Cy (see Appendix I).

Through a CS/Cy sector strategy, Arizona industry and community college faculty have closely collaborated to design and implement a CS/Cy program of study that leads to the credentials and degrees desired by industry, including identifying the key DE courses to be delivered in the high school. As part of the Arizona Pathways to Prosperity work, many high schools across Arizona are already delivering these courses, and the framework exists to expand the pathway to additional high schools as student demand increases. However, school partners have identified that lack of student interest and enrollment in CS/Cy is resulting in severely under-utilized programs of study. *A critical missing link is effective career literacy, guidance, and support associated with CS/Cy and specifically targeted to meet the unique needs of high-need students.*

Developing Promising New Strategies. The *CCP* project will develop strategies to ensure

that students, especially high-need students, have access to—and the ability to use—high-quality, relevant, and timely career information in order to make sound educational decisions during high school that will propel them to and through postsecondary education, ultimately leading to a good job. The *CCP* strategy is based on an extensive body of research that points to the need for high-quality college and career advising. Typical resources and best practices for guidance counseling and social-emotional development do not prioritize specific information about the world of work and professional identity development as key pieces to be integrated into a young person's high school experience. In addition, students often have little information about careers because current school structures and expectations of guidance counselors and teachers are not always in line with comprehensive career development services. Consequently, students rely on family members or their immediate social network to supply information about possible career options, which may be limited. *The CCP project responds to this research with a strategy for a developmental approach to career advising that follows students through high school and postsecondary education and helps students make more informed, economical, and sustainable career choices by helping them better understand what they are interested in and why, what career opportunities are available in their region, and what skills, education, and training are required to pursue those professions*. *CCP* strategies and resources will be designed to fit the needs of students and families, particularly **high-need students/families,** and will take into account critical audience considerations, such as translation and avoiding the use of education and postsecondary jargon.

In addition, the *CCP* strategy, particularly the *Career-Connected Toolkit*, responds to research that shows that students often have little access to data, such as job growth and average wages, about career possibilities, even though this data can have a significant impact on students' decision-making. The *CCP* project will ensure that teachers and counselors have access to high-

quality labor market information (LMI) resources and are trained on how to use LMI to connect students to the world of work. A literature review on the impact of LMI on the career decision-making process suggested that providing LMI data in conjunction with guidance had a significant impact on students' career decidedness (Savard & Michaud, 2005).

Research on the effectiveness of near peer mentoring models will also shape the *CCP* project's strategy. Students, particularly high-need students who may not naturally see themselves in STEM fields, need support to achieve and persist in CS/Cy pathways. Near peer mentor models in which college students serve as mentors to high school students in a structured experience show promise as a strategy to increase interest and motivation within STEM fields (Wilson & Grigorian, 2019). Near peer mentorship provides support for student motivation and persistence through academic difficulty (Destin et. al, 2018). A study of the Sundial Project, a near peer mentoring program at Arizona State University, found high persistence rates and strong GPAs among program participants (Zaniewski & Reinholz, 2016). The *CCP* project will design and test a system and process for high school and community colleges to build a near peer mentor program, specifically designed to improve student achievement and persistence in CS/Cy pathways.

The *CCP* project has national implications in that it will create a replicable, scalable model for college and career advising that can be adopted for use across Arizona, including in rural schools, and in other states. As a national leader and technical assistance provider for pathways development, JFF will support dissemination and replication of *CCP* strategies.

B. QUALITY OF THE PROJECT DESIGN

B.1. Measurable goals, objectives, and outcomes. The *CCP* project will create and implement innovative, evidence-based, field-initiated strategies and interventions that measurably improve outcomes for students, especially high-need students. The goals, objectives,

and measures for the *CCP* project are based on our theory of action: high-quality career information and advising frameworks, models, and resources will increase the number of students who enter and persist in DE CS/Cy pathways. Table 1 outlines the two goals the CCP project addresses and accompanying objectives, measures, and outcomes.

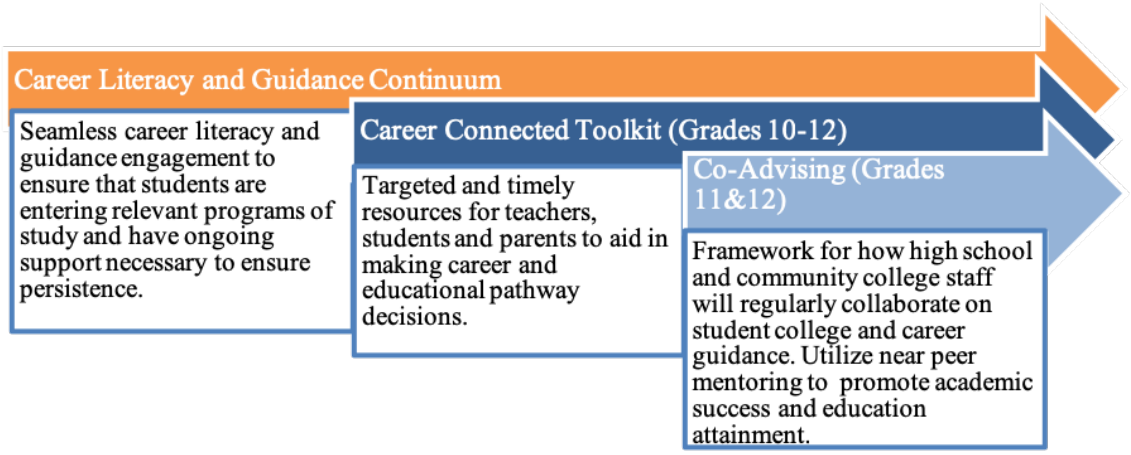
Table 1. Goals, Objectives, Measures, and Outcomes

Objectives	Measures	Outcomes
Goal 1: Through the development and implementation of targeted, relevant career advising resources and outreach activities, more students, particularly high-need students, will enroll in foundational dual enrollment (DE) classes in math, writing, and computer science		
1.1 Increase the number of computer science, math, and writing DE courses offered in schools	**1.1a** All 24 partner schools have DE courses offered in targeted computer science, math and writing **1.1b** 25% increase in the number of high-need students enrolled in DE math courses **1.1c** 25% increase in the number of high-need students enrolled in DE writing courses **1.1d** 25% increase in the number of high-need students enrolled in DE computer science courses	• Increased interest in and preparedness for CS/Cy pathways among high-need students • Increased enrollment of high-need students in CS/Cy pathways • High-need students successfully launch careers in in-demand STEM fields, including CS/Cy
1.2 Increase educators' skills and knowledge through the development of resources to promote the educational and career pathways to students and parents	**1.2a** 75% of users report being "somewhat satisfied" or "satisfied" on a Likert Scale **1.2b** 75% of users report using the resources as intended **1.2c** 5 teachers and/or counselors per school have received training on use of the resources **1.2d** Resources are used in 24 schools	
1.3 Increase the number of high-need students experiencing high-quality career literacy and guidance activities, both in school and through outreach experiences	**1.3a** 2 events held per school per year **1.3b** 50% increase in the number of students accessing high-quality career guidance materials and activities **1.3c** 75% of students and parents report satisfaction with materials and events	

Goal 2: Through the development of a co-advising and near peer mentoring model, an increased number of students, especially high-need students, will successfully complete DE courses and persist in DE pathway courses		
2.1 Increase capacity of K12 districts and community colleges to deliver an aligned college and career advising framework that incorporates information on computer science coursework and career pathways	**2.1a** 20 students per school participating in advising activities **2.1b** 4 collaboration meetings held across K12 and postsecondary institutions **2.1c** 75% of high school and 75% of community college faculty/staff report in a survey that they have changed their advising practices based on the framework	• High-need students successfully graduate from high school • High-need students succeed in college coursework, especially STEM and CS/Cy coursework • Students are enrolling and succeeding in STEM dual enrollment courses that propel them to college and career success • High-need students enter and succeed in postsecondary CS/Cy programs of study
2.2 Increase high-needs student engagement in computer science pathway planning through the development and implementation of a near peer mentoring program between high school and community college students	**2.2a** 75% of students participating in the program indicate via survey that they are satisfied with the program and that it has provided additional support **2.2b** 120 mentors trained and prepared to support high-need students in the program **2.2c** 20 students per school participating in the program	
2.3 Increase collaboration between K12 and community college partners by implementing a plan for ongoing communication, professional development, and peer to peer support	**2.3a** Collaboration plan is created and implemented **2.3b** 2 convenings that bring together K12 and postsecondary partners are held to facilitate planning and collaboration **2.3c** 75 high school and community college faculty and staff members attend convenings **2.3d** 75% of participants indicate on a survey that collaboration has increased	

B.2. Conceptual framework. The *CCP* project will address the critical need for connected, seamless career guidance and support to ensure that students, particularly high-need students, are entering and persisting in relevant CS/Cy pathways leading to high-demand, high-wage jobs. The project consists of two important implementation levers: 1) a *Career Connected Toolkit* consisting of resources for educators, students and parents; 2) a *Co-Advising Framework to include a Near Peer Mentoring Model* to facilitate better collaboration between K12 schools and

community colleges and to increase enrollment and improve persistence in DE courses. A high level conceptual framework for the project is depicted below.



Our logic model, included in Appendix G, depicts how our multi-pronged approach will: 1) provide schools, students, and families the information and resources they need to make sound decisions about the opportunities in CS/Cy and the educational pathways necessary to obtain jobs in the field; 2) how community colleges and high schools will work together to provide coherent and connected guidance to students through co-advising; and 3) how the approach will implement and test a near peer mentoring model designed to increase student outcomes.

The first step of the project is to design, develop and implement a quality *Career Connected Toolkit,* which will consist of classroom lessons connecting high school coursework to career and postsecondary pathways and to relevant, timely information on LMI and industry demand. During the development and iteration phase, we will form a team of critical stakeholders, including CS/Cy industry leaders, high school and community college teachers and counselors, high-need students, parents, and key community members to design the *Career Connected Toolkit*. Special consideration will be given to meeting the needs of high-need students and special populations (e.g., English Language Learners). Teachers implementing the toolkit will be trained on the resources and in-class application during a 2-day face-to-face professional

development experience. Toolkit implementation will begin in the 10th grade because that is when students are making critical decisions on which high school courses to take. They will then have two years to complete DE courses in CS/Cy. Toolkit implementation will also include supports for K12 educators to communicate with families about pathways.

The next step of the project design is to develop a *Co-Advising Framework, to include a Near Peer Mentoring Model,* utilizing a team of key community college faculty and career navigators and high school teachers and counselors. The *Co-Advising Framework* will support high school and college counselors and advisors to regularly collaborate and will detail a strategy for creating a seamless secondary-to-postsecondary advising experience for students. The ongoing plan for co-development of processes, procedures, communications, and materials will be outlined in the *Co-Advising Framework.* Student and parent feedback will be solicited during the design and implementation phases.

To further support students once they enter CS/Cy pathways, the *Co-Advising Framework* will include a *Near Peer Mentoring* program for students enrolled in DE CS/Cy courses. Mentoring will be provided by community college students who will be trained through a mentor development workshop offered once a semester. We will solicit input from participants and mentors to design a contextually-relevant mentorship framework that provides treatment students with needed support to persist in DE courses in CS/Cy. *The Near Peer Mentorship* framework will focus on promoting academic success and goal attainment.

B.3. Procedures for feedback and continuous improvement. Performance management and continuous improvement are key considerations for CFA and our partners. A **Grant Management Team** (GMT), led by CFA and comprised of key personnel from JFF and Lead Local (LL) will oversee project implementation, development and iteration, data collection and review. *CFA will conduct monthly calls* with the GMT to monitor progress, evaluate data

collected, determine course corrections needed and troubleshoot issues. To ensure timely feedback and course correction mechanisms are in place, *we will use a Plan-Do-Study-Act (PDSA) model of continuous improvement* during the development and iteration phase in years 1 and 2. Formal feedback will be gathered at regular intervals and will include survey data from all stakeholders, including teachers, counselors, students, parents, and others who interact with the project. *Observations and focus groups will also be conducted at key intervals* to inform the design and iteration phase of the project. Survey data will be shared with the GMT and will be used to improve and refine the project deliverables. SRI's implementation study will support continuous improvement as the project develops, providing CFA with early actionable feedback. Implementation fidelity data will be collected during the pilot and launch phases and will provide data results to the GMT in order to quickly identify and correct any implementation issues. In years 3 through 4, we will continue to use an iterative process to implement, test and refine as the project expands to add additional school cohorts. During year 5, SRI will conduct a formal evaluation for reporting and dissemination.

C. ADEQUACY OF RESOURCES AND QUALITY OF MANAGEMENT PLAN

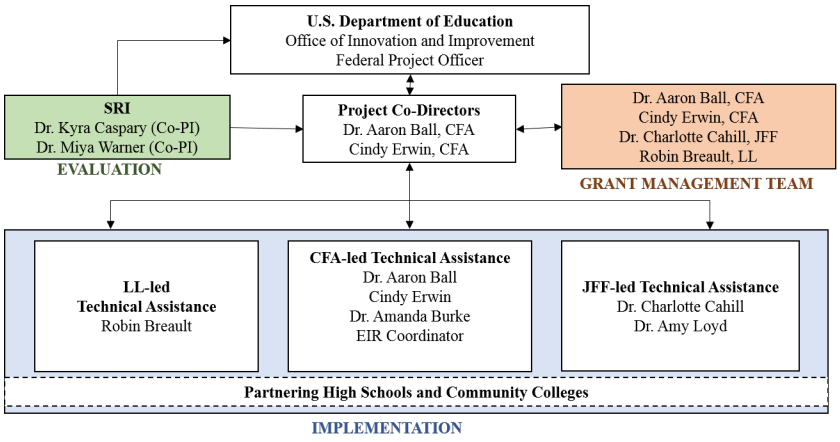
C.1. Project management plan and timeline. The *CCP* project will be designed and implemented through a partnership between CFA, JFF, and LL, with each partner serving in a specific role based on deep levels of expertise and experience. SRI International (SRI) will serve as the independent evaluator. The organizational chart (Chart 2) shows the reporting relationships for the partner organizations.

With a solid track record for moving innovation to implementation and policy to practice, CFA is uniquely positioned to lead this work and provide strategic direction, oversight and project management. For 15 years, CFA has worked with state agencies, hundreds of schools, and other partners to drive innovation and improvement across the education industry. CFA has

deep expertise, credibility, and relationships in the areas of college and career pathways and workforce development. This includes leading, at the direction of the Office of the Governor, the statewide Pathways to Prosperity initiative supported by a significant public-private-philanthropic partnership.

As a primary partner, *JFF provides deeps expertise and national leadership in aligning workforce and education to connect students, particularly high-need students, to career pathways and high-wage, high-demand STEM jobs*. JFF has been a national leader in scaling dual enrollment for more than 15 years. JFF will provide thought leadership, design input, and technical assistance throughout the project. LL, a nonprofit organization, provides expertise in the area of student career guidance and near peer mentoring. LL partners with community stakeholders to develop adaptable education and youth development program models and toolkits based on inclusive design methodologies derived from participatory action research, systems thinking, design thinking, and equity redesign models.

Chart 2: CCP Project Organizational Chart



SRI International (SRI) will serve as the *CCP* project evaluator. SRI has extensive experience in the education and learning industry and works with government agencies, non-profits, and school districts to identify trends, understand outcomes, and support teachers in real world settings. SRI will ensure implementation fidelity, provide input on iterative design data collection, and conduct the formal project evaluation.

For years 1-2 of the grant period, a cohort of 5 high schools in 4 districts and 3 community

colleges will participate in the development and pilot of *Career Connected Toolkit* and the *Co-Advising Framework*. In Year 3, we will implement, test and refine the *Near Peer Mentoring* model with students who have enrolled in the CS/Cy pathway in 11th grade in schools in the initial cohort. In year 3, CFA will recruit an additional 19 high schools from 10-12 districts for a total of 24 high schools and 3 community colleges participating in years 3 -5. Five educators from each of the high schools will participate in the training and will be provided the *Career Connected Toolkit* resources. Implementation, testing and refinement of the *Co-advising Framework and Near Peer Mentoring* will continue as new schools are added.

Table 3. Project Management Plan and Timeline for Tasks

Milestones	Begin-End Dates	Responsible Parties	Alignment to Objectives and Measures in Table 1
Development and Iteration Phase (Years 1-2)			
Goal 1: Development and implementation of career advising resources and outreach activities, to increase enrollment in foundational DE classes in math, writing, and computer science			
Identify existing and targeted DE courses, inventory courses in partner schools, and develop plan to address gaps	11/19-7/20	CFA	O1.1, M1.1a, M1.1b, M1.1c, M1.1d
Complete an inventory and gap analysis of currently available career advising resources, including websites, pathway maps, LMI, postsecondary guides, and other relevant materials	11/19-1/20	CFA, LL	O1.2, M1.2a, M1.2b, M1.2d
Inventory existing student outreach activities, information, and communication tools and identify additional resources for development	11/19-1/20	CFA, LL	O1.3, M1.3a, M1.3b, M1.3c
Develop resources and outreach activities for the Career-Connected Toolkit that leverage and supplement existing high-quality materials	1/20-4/20	CFA, LL	O1.2, M1.2a, M1.2b, M1.2d
Develop teacher 2-day PD for resource toolkit	4/20-5/20	CFA, JFF	O1.2, M1.2c
Provide teacher professional development for 5	6/20	CFA, LL	O1.2, M1.2a,

teachers from each Cohort 1 school			M1.2b, M1.2c, M1.2d
Identify needed DE courses and work with Cohort 1 schools to increase DE course offerings where needed	8/20-1/21	CFA, JFF	O1.1, M1.1a, M1.1b, M1.1c, M1.1d
Create and pilot outreach strategies that target high-need students and develop activities, information, and communication tools for students and parents	11/20-4/21	CFA, JFF	O1.3, M1.3a, M1.3b, M1.3c, M1.3d
Goal 2: Development of a co-advising and near peer mentoring model to increase persistence and completion in DE courses and pathways			
Identify key high school and community college staff to participate in co-advising framework development	11/19	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Develop meeting schedule and set deliverables for co-advising framework development team	12/19	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Convene high school and community college partners to develop the framework	1/19	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Develop co-advising framework and inventory educational pathway materials, assessing for alignment between high school and postsecondary and updating materials as needed	1/19-6/20	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Identify Cohort 1 K12 and community college partners to participate in a peer-to-peer group to foster collaboration and resource sharing	3/20	CFA	O2.3, M2.3a, M2.3b, M2.3c, M2.3d
Convene Cohort 1 K12 and community college peer-to-peer group participants to develop a collaboration plan and learning agenda	5/21	CFA	O2.3, M2.3a, M2.3b, M2.3c, M2.3d
Support Cohort 1 secondary and postsecondary educators in implementing co-advising framework and utilizing resources	8/20-6/21	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Convene co-advising framework development group for collaboration meeting to identify needed revisions to the framework	10/21	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Develop near peer mentoring framework, processes, and procedures	2/21-5/21	CFA, LL	O2.2, M2.2a, M2.2b, M2.2c
Design 2-day training for community college	5/21-6/21	CFA, LL	O2.2, M2.2b

student near peer mentors			
Recruit and train community college near peer mentors for students in Cohort 1 schools	8/21	CFA, LL	O2.2, M2.2b
Recruit additional 19 partner schools for Cohort 2	2/21	CFA, LL	O2.1, M2.1a, M2.1b, M2.1c
Efficacy Study Phase (Years 3-5)			
Goal 1: Development and implementation of career advising resources and outreach activities, to increase enrollment in foundational DE classes in math, writing, and computer science			
Provide teacher PD for 5 educators from each Cohort 2 school on use of the Career-Connected toolkit	6/21	CFA	O1.2, M1.2a, M1.2b, M1.2c, M1.2d
Provide additional PD on the toolkit as needed for any new teachers due to attrition	6/22, 6/23, 6/24	CFA, LL	O1.2, M1.2a, M1.2b, M1.2c, M1.2d
Assess ongoing pathways alignment between secondary and postsecondary and update DE courses as needed	Annually in May	CFA	O1.1, M1.1a, M1.1b, M1.1c, M1.1d
Revise and refine outreach strategies that target high-need students and develop activities, information and communication tools for students and parents	11/22-4/23	CFA, JFF	O1.3, M1.3a, M1.3b, M1.3c, M1.3d
Goal 2: Development of a co-advising and near peer mentoring model to increase persistence and completion in DE courses and pathways			
Convene Cohort 1 and Cohort 2 K12 and community college peer-to-peer group participants to reflect on successes and challenges in implementing collaboration plan and learning agenda and to revise as needed	5/21	CFA	O2.3, M2.3a, M2.3b, M2.3c, M2.3d
Convene co-advising framework development group for collaboration meeting to identify needed revisions to the framework	10/22, 10/23	CFA, JFF	O2.1, M2.1a, M2.1b, M2.1c
Pilot near peer mentoring framework with 5 Cohort 1 schools	8/21-5/22	CFA, LL	O2.2, M2.2c
Revise and improve near peer mentoring framework and mentor training based on feedback from Cohort 1 participants	5/22-8/22	CFA, LL	O2.2, M2.2a, M2.2b, M2.2d

Recruit and train community college near peer mentors for students in Cohort 2 schools	8/22	CFA, LL	O2.2, M2.2b
Recruit and train community college near peer mentors on an ongoing annual basis as needed	8/23, 8/24	CFA, LL	O2.2, M2.2b

C.2. Qualifications of Key Project Personnel. Each of the partnering organizations brings exceptionally qualified personnel with deep expertise in issues and methodologies that are highly relevant to the *CCP* project. Key project personnel and their responsibilities are detailed below.

Key Project Personnel & Responsibilities
Amanda Burke, Ed.D., Managing Director, Strategic Initiatives and Impact, CFA. Will provide strategic leadership in bringing education and public policy systems together to increase opportunity for students; support execution of large-scale innovative efforts; advance statewide policy supports.
Cindy Erwin, Director, College and Career Pathways, CFA. Project Co-Directors, Cindy Erwin and Dr. Aaron Ball, will oversee grant planning, implementation, and management; work closely with school partners to ensure fidelity in implementation and progress towards project goals and objectives.
Aaron Ball, Ed.D., Director, College and Career Pathways, CFA. Project Co-Directors, Cindy Erwin, and Dr. Aaron Ball will oversee grant planning, implementation, and management; work closely with school partners to ensure fidelity in implementation and progress towards project goals and objectives.
TBH, EIR Coordinator, CFA. Will support the day-to-day grant operations, coordinate communications with partner schools, and provide direct support to partner schools and management team.
Charlotte Cahill, Ph.D., Director, Pathways to Prosperity Network, JFF. Will bring national expertise in pathways and dual enrollment and will oversee and manage all implementation activities to be carried out by the JFF team in collaboration with project partners.
Amy Loyd, **Ed.L.D**, Associate Vice President, Building Educational Pathways for Youth, JFF. Will bring national expertise in pathways, dual enrollment, and strategies to support high-need students and will provide overall strategic advising for the project. She will serve as the lead contact with CFA staff.
Robin Breault, Co-founder, LeadLocal. Will provide facilitation and support for development of Career Connected Toolkit and Near Peer Mentorship model.
Kyra Caspary, **Ph.D.,** Principal Researcher, Center for Education Research & Innovation, SRI Education. As Evaluation Co-Principal Investigator, Dr. Caspary will provide intellectual leadership to the evaluation and, along with Dr. Miya Warner, will be responsible for the overall quality of all deliverables and products, as well as managing the team of researchers and ensuring that the evaluation is conducted on time and on budget. She will lead the research design and assessment of implementation fidelity, participate in all project activities, interpret findings as they emerge, and prepare study results for dissemination. She will serve as the lead contact with CFA staff.
Miya Warner, **Ph.D.,** Senior Researcher, Center for Education Research & Innovation, SRI Education. As Evaluation Co-Principal Investigator, will provide intellectual leadership to the evaluation and, along with Dr. Kyra Caspary, will be responsible for the overall quality of all deliverables and products, as well as managing the team of researchers and ensuring that the evaluation is conducted on time and on budget. She will participate in all project activities, interpret findings as they emerge, prepare study results for dissemination and participate in communication with CFA staff.

C.3.Potential for Continued Support After Federal Funding Ends. The *CCP* project is designed to ensure continued support and sustainability. The *Career Connected Toolkit,* the *Co-Advising Framework* and the *Near Peer Mentorship Model* are all resources that can be maintained by the partners with little additional cost. The practices and processes developed during the project will be operationalized within the community colleges and high school schools. Through the support of the Arizona Department of Education, resources and learning will be shared and available across the state. In addition, all strategies and resources developed for the project will be made available and disseminated through JFF's Pathways to Prosperity Network, allowing for national replication and scale of the *CCP* project.

D. QUALITY OF THE PROJECT EVALUATION

Guided by five key research questions (Table 4), SRI International will conduct a rigorous, independent evaluation of *CCP* that will: 1) provide formative feedback to CFA to guide program development; 2) measure the extent to which *CCP* is implemented as intended, and; 3) estimate CCP's impact on dual enrollment credit attainment and high school graduation. SRI's implementation study will support continuous improvement as the project develops, providing CFA with early feedback to refine their program and generating quantitative implementation measures. Beginning in year 3, SRI will conduct an efficacy evaluation designed **to meet the What Works Clearinghouse (WWC) standards with reservations**. SRI will draw on findings from both the efficacy and implementation studies to document strategies for scaling and replicating the approach both during and after the grant period.

Table 4: Career Connected Pathways Evaluation Research Questions

Q1. Confirmatory Impact (Intent-to-treat effect)	For all students in CCP schools, what is the effect of CCP on the number of dual enrollment credits students earn and likelihood of graduating from high school?
Q2. Exploratory Impact (Treatment-on-treated)	For all students who enroll in at least one CCP class in 11th grade, what is the effect of CCP on the number of dual enrollment credits students earn and likelihood of graduating from high school?
Q3. *Moderation*	Do effects of CCP vary by student subgroups (e.g., based on gender,

	underrepresented minority status, and free or reduced price meal (FRPL) eligibility)?
Q4. Implementation	To what extent was CCP implemented as intended? What contextual barriers or facilitators impede or enhance implementation? How do implementation and outcomes vary by district and what guidance does that provide for replicating CCP in other settings?
Q5. *Mediation*	To what extent do key program components mediate the impacts of CCP on student outcomes?

Impact Study

Beginning in year 3, SRI will conduct a **rigorous quasi-experimental design study** that will meet WWC standards with reservations. The **impact study will examine two student outcomes available from school and community college district student datafiles—high school graduation** (i.e., earning a regular high school diploma within 4 years of starting high school) **and completion of dual enrollment credits—specified in the WWC Transition to College review protocol** (U.S Department of Education, 2016).

RQ1, Confirmatory Impact Estimates. For our confirmatory impact analyses, treatment students will be all 10th graders (class of 2024) enrolled in *CCP* partner schools in the 2021-22 school year. Comparison students will be all 10th graders enrolled in high schools not implementing *CCP* in that school year that are in the same districts. In accordance with WWC v3.0 Group Design Standards (U.S. Department of Education, 2014) and the WWC Transition to College v3.2 review protocol (U.S. Department of Education, 2016), SRI will verify baseline equivalence between treatment and comparison students on demographic and prior achievement variables available from district student data: AzMERIT, Arizona's 8th grade statewide standardized assessment in both ELA and math, and on student socioeconomic status (e.g., FRL eligibility). If baseline equivalence is not established between treatment and comparison students, SRI will employ propensity score weighting to ensure baseline equivalency between the two conditions (Li et al., 2018). SRI will report baseline comparisons on all student covariates used in the impact analyses (e.g., prior achievement, gender) for maximum

transparency. All data will be analyzed in accordance with WWC standards, using hierarchal linear modeling to adjust for clustering of students within schools.[1]

Analysis of student outcomes. SRI will use a two-level hierarchical model with student and school levels, with *CCP* program impacts estimated at the school level. For student *i* in school *j*, the model is:

$$Y_{ij} = \beta_0 + \beta_1 (CCP_j) + \beta_k (\text{kth student covariate}_{ij}) + \beta_l (l\text{th school covariate}_j) + e_{ij} + r_j$$

where Y_{ij} is a student outcome score; CCP*ij* equals 1 for *CCP* schools and 0 for comparison schools; and e_{ij} and r_j are student and school random effects. β_1 is the estimated impact of CCP on the student outcome. SRI includes a vector of grand-mean centered student- and school-level covariates (e.g., both students' own prior achievement scores and the school's mean achievement scores). Linear and logistic functions will be applied for continuous and dichotomous outcomes respectively.

RQ2, Exploratory impact estimates. While the intent-to-treat analyses in RQ1 will provide the strongest evidence of *CCP* impact, SRI will also analyze the effect of *CCP* on high school graduation for treatment school students who enrolled in at least one dual enrollment class in 11th grade during the 2022-23 school year (Class of 2024). This will provide a test of concept by analyzing *CCP* impacts on graduation for those students who experience all program components.

RQ3, Moderation analysis for student outcomes. To examine the potential differential impact of CCP on different student subgroups, SRI will run additional exploratory analyses that include an interaction term between the *CCP* impact and student subgroup indicators (e.g., gender, underrepresented minority status, and FRL status), building one interaction model for

[1] Note that as this study includes two confirmatory outcomes in different domains (college readiness and completing high school, per the WWC Transition to College v3.2 review protocol (IES, 2016), we do not anticipate needing a Benjamini-Hochberg correction for multiple comparisons.

each moderator.

Power analysis for student outcomes. The minimum detectable effect size (MDES) for the overall student outcomes analysis is 0.22. This MDES calculation assumes an average of 450 10th graders per school in 24 treatment and 26 comparison schools (see Appendix I for partner districts and their high schools), that 10% of the variation in student test scores lies in the school level, and that student 8th-grade test score and other covariates explain 30% of the between-school and 20% of the between-student variations. The MDES for the exploratory, treatment-on-treated analysis is also .22, even with a smaller assumed sample of 600 treatment students who enroll in pathway courses.

Implementation Study

Data sources. SRI will study program implementation across multiple settings and with diverse populations. SRI will interview school staff and community college partners using semi-structured interview protocols to learn about implementation and the perceived program effects on student motivation and interest in technology-related careers. SRI will observe school staff trainings in summer 2020 and 2021 using a protocol to capture the extent to which these trainings meet the articulated goals. SRI will also collect program data from CFA and partner community colleges. Finally, SRI will administer logs to trained school staff to query how frequently they integrate discussion of labor market data into their lessons. SRI will provide briefings to the Grant Mangement Team to help refine the planned model, starting with formative feedback and reporting on implementation fidelity beginning in year 3.

RQ4, Fidelity of Project Components. A prerequisite to interpreting impact findings is establishing whether the key program components were implemented with fidelity. The design of the proposed evaluation is based on clearly articulated key *CCP* components, mediators, and outcomes as depicted in the logic model (Appendix G). Table 5 proposes data sources and

measurable thresholds for each project component. SRI will measure the high school career awareness component in the 2021-22 school year, and the dual credit access and enrollment and the peer mentoring components in the 2022-23 and 2023-24 school years; SRI will pilot and define each measure before full implementation. The *CCP* schools in each partner district must meet each component's threshold to reach fidelity each year; to meet overall project fidelity for a year, 10 of 12 districts must meet fidelity.

Table 5: Implementation Fidelity Metrics for Career Connected Pathways Evaluation

Activity	Metric	Data Source
Component 1: High school career awareness		
Teacher training	At least 5 staff from each participating school participates in 16 hours of training (10th grade math or science teachers, counselors or other student advisement staff)	• Program attendance records • Training observation
Cybersecurity career and pathway awareness activities embedded in 10th grade STEM courses (2021-22)	Math and science teachers integrate labor market data into lessons. Career Counselors present 2 times per year in math and science classes	• Program records • Teacher logs
Cybersecurity career events	Each partner school hosts at least two career events targeting 10th grade students and their parents/guardians during the 2021-22 school year	• Interviews with school staff • Program records
Component 2: Dual credit opportunities		
Dual credit course offerings	All partner schools offer dual credit introduction to computer science course in 2022-23 and 2023-24.	• Interviews with community college partners • Program records
Enrollment in dual-credit pathway courses	(a) At least 20 students per partner school enroll in dual-credit foundational computer science course in 11th grade (b) At least 25 students per partner school enroll in dual-credit writing, math, or foundational computer science course in 11th or 12th grade	• School and community college district student data
Component 3: Near Peer mentoring		
Peer mentor training	5 community college peer mentors trained per partner high school each year (2-hour training), early fall 2022 and 2023	• Program records
Peer mentoring	Peer mentors visit each Introduction to Computer Science course section twice	• Program records

	each semester in the 2022-23 and 2023-24 school years	

RQ5, Mediation Analysis. SRI will also conduct mediation analyses to understand the CCP elements critical to its effectiveness. SRI hypothesizes teachers' integration of labor market data into lessons, percent of students attending cybersecurity career events, and students' receipt of peer mentoring are most likely to mediate the effects of *CCP* on dual credit accumulation. Further, SRI hypothesizes that these mediators plus enrollment in dual credit coursework are likely to mediate high school graduation. SRI will use structural equation modeling (SEM) to test mediation effects of these components because of its superior ability compared to regression models (Iacobucci et al., 2007; Holbert & Stephenson, 2002; Little, et al., 2007) to address measurement error. These models will estimate the proportion of any estimated *CCP* impacts mediated through each of these mediators, allowing for a better understanding of which program components are most critical to *CCP's* success.

Strategies for Replication in Other Settings

SRI will carefully examine sites that implement with fidelity to the *CCP* model, triangulating fidelity data with our understanding of each district's success gained through qualitative data collection and regular meetings with the Grant Management Team. When analyzing student data, SRI will run exploratory impact estimates and rich descriptives on program uptake (e.g., dual enrollment credits taken by class for each high school) for each individual district, allowing us to compare district-level impacts with district implementation findings. For each of these topics, researchers will pay close attention to local contextual factors that support or inhibit successful replication, documenting variation in implementation and adaptation to local needs. **Final analysis will triangulate the local site contextual data with site-level implementation and impact estimates to identify critical project components that can be replicated and sustained in various conditions.**

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