

Significance

The Citizen Scientist Residency Pathway (CSRP) is designed to bring together the fields of civic empowerment and STEM education, with an emphasis on computer science (STEM-C), in order to prepare middle and high school teachers and students for the demands of scientifically literate citizenship in the 21st Century. The need for this type of interdisciplinary work is based on three interrelated challenges to and opportunities for meeting the needs of all students.

First, Levinson (2012) demonstrated the existence of a civic empowerment gap in K-12 education. Specifically, children of color and children from high poverty backgrounds are less likely to be civically engaged in their communities and thus less likely to hone their political voice in ways that enable them to individually or collaboratively address issues of public concern. Further research illuminates that recent immigrants and those less proficient in English have far less voice in political processes (APSA, 2004; Lenhardt, et.al., 2010). The civic empowerment gap has implications for student achievement, dropout rates, and students' matriculation into post-secondary education (Jonathan, Jamieson, Levine, McConnell, & Smith, 2011). Second, recent studies found that children spend, on average, nine hours a day consuming digital media (Common Sense Media, 2015). Civic education scholars (Kahne, Ullman, & Midaugh, 2012) call for leveraging children's high levels of media engagement to increase their participation in civic and political life. Most germane to this project are calls to engage students as hardware and software designers, coders, and computer application developers in the creation of digital civic infrastructure (i.e., websites, apps, video games, computer programs) to serve as mediums and catalysts for their civic and political engagement. Lastly, with respect to students' ability to hone their computer science competencies, there is a shortage of highly qualified

STEM-C teachers in California. In the next ten years, California will need a projected 33,000 more STEM-C teachers and the demand for credentialed teachers is higher than the supply of candidates who are fully qualified (Ruble, 2017). Given the representation gap that exists in STEM-C fields for racial and ethnic minorities, women, and people with disabilities (National Science Foundation, 2017) and a similar representation gap between teachers and the students they serve (Department of Education, 2016), the recruitment, retention, and induction purposes and processes must be designed to ensure equal access and treatment of teacher candidates who have traditionally been underrepresented based on race, color, national origin, gender, age, or disability.

Research addressing civics-focused STEM-C education, with an emphasis on the development of digital civic infrastructure, especially research designed to address gaps in civic engagement and STEM-C achievement for underrepresented groups, is in its fledgling stages (Kahne, Ullman, & Midaugh, 2012). As a result, the work of the Citizen Scientist Partnership Project demands innovation in curriculum, pedagogy, and assessment. The rationale for the Project is contoured by these gaps in literature and the ways in which our teacher education programs currently reflect these same gaps. Each of our Residencies contain only one science methods and assessment course and neither the unique demands of citizen science nor computer science is addressed due to limited time, resources, and clinical opportunity. The children we serve, too, demonstrate deep opportunity gaps in civics and STEM, as evidenced by their scores on state tests in science, math, and literacy.

To address these interconnected needs, California State University, Bakersfield (CSUB), Department of Teacher Education, in partnership with CSUB Department of Computer and Electrical Engineering and Computer Science, The Kegley Institute of Ethics (KIE), Bakersfield

City School District (BCSD), Kern High School District (KHSD), and Greenfield Union School District will leverage the learning and existing partnerships from three teacher residency programs, Kern Urban Teacher Residency, Kern High School District Residency, and Kern Teacher Residency-Greenfield to create a more robust pathway to prepare 240 multiple subject and 240 single subject STEM-C credential completers over five years as part of a fifth year initial licensing program. In particular, the Citizen Scientist Residency Pathway addresses the need for highly qualified educators who are able to engage research-based best practices in the fields of STEM-C, computer science, and civic empowerment education to enhance the rigor and relevance of STEM-C content and pedagogy for historically marginalized middle and high school teachers and students.

Quality of the Project Design & Services

The extent to which the proposed project represents an exceptional approach to the priority or priorities established for this competition.

The Citizen Scientist Residency Pathway (CSRP) will address ***Absolute Priority 1: Partnership Grants for the Preparation of Teachers*** by leveraging the learning and existing partnerships from three teacher residency programs to create pathways for the preparation of 240 postbaccalaureate multiple subject science, technology, engineering, and math, with an emphasis on computer science (STEM-C), credential completers and 240 single subject STEM-C credential completers over five-years as part of a fifth-year initial licensing program.

The Citizen Scientist Residency Pathway (CSRP) also addresses the need for highly qualified STEM-C educators who are able to create and facilitate interdisciplinary STEM-C lessons that engage local issues and help students translate STEM-C concepts into civic action,

with an emphasis on the development of digital civic infrastructure. The scope of this project thus addresses *Competitive Preference Priority 1: Promoting Science, Technology, Engineering, or Math (STEM) Education, With a Particular Focus on Computer Science*. The design of this project also addresses *Competitive Preference Priority 2: Promoting Effective Instruction in Classrooms and Schools*. Specifically, the Project will engage experts in the fields of STEM, computer science, and civics education to co-create civics-focused STEM-C curriculum, pedagogy, assessment protocols, professional development, methods courses, elective courses for middle school and high school students, year-long coaching cycle based, and two year induction programming support in civics-focused STEM-C teaching and learning.

The extent to which the services to be provided by the proposed project reflect up-to-date knowledge from research and effective practice.

CSRP innovations are based on current research connected to high leverage practices (Ball and Forzani, 2011); evidence-based practices in K-12 civic empowerment (Levinson, 2012); high priority Resident practices (NCTR, 2018); community immersion approaches (Waddell, 2013); high impact clinical preparation (Darling-Hammond & Lieberman, 2012); improvement sciences (Bryk, A. et al., 2015); and alignment to state (Common Core State Standards) and national (College, Career, and Civic Life Framework; Next Generation of Science Standards) standards and priorities in civics, STEM-C, and literacy. The programs structures and strategies are designed based on the Logic Model (Appendix G) and System Design (Figure 1).

The Citizen Scientist Residency Pathway has three core goals: 1) Develop a pathway to increase the capacity of 240 multiple subjects credential and 240 single subject credential Residents to design, facilitate, and assess high quality, civic-focused STEM-C pedagogy and

curricula in high-needs schools; 2) Sustain a pipeline of credentialed teachers who are committed to teaching in civics-focused STEM curricula in high needs school districts by creating tailored recruitment, retention, and induction processes; and 3) Co-create and co-implement curriculum and multi-stakeholder structures for professional development that supports teacher leaders, site administrators, superintendents, and university faculty's use of research-based best practices in the domains of teacher recruitment, retention, and induction, with an emphasis on civics, STEM, and computer science teacher and learning.

The extent to which the goals, objectives and outcomes to be achieved by the proposed project are clearly specified and measurable & the training or professional development services to be provided by the proposed project are of sufficient quality, intensity, and duration to lead to improvements in practice among the recipients of those services.

Citizen Scientist Residency Pathway Goal One. Develop a multi-residency pathway to increase the capacity of 240 multiple subject credential and 240 single subject credential Residents to design, facilitate, and assess high quality, civic-focused STEM-C curricula, pedagogy, and assessment in high-needs schools.

Civics-focused STEM-C Summer Institutes: Launch & Capstone. The Citizen Scientist Residency Pathway will launch with the Citizen Scientist Institute, which will take place the summer before Residents begin their clinical practice at their respective LEA school sites. The Institute will bring together Residents, IHE faculty mentors, LEA teacher mentors, and middle and high school students from the partnering LEA districts to participate in a three-week clinical co-teaching experience. During the first Institute, incoming Residents will assume the role of observers and co-teachers with mentor teachers from one of the LEA districts as they begin to

engage with civics, STEM, computer science, and the intersections of these disciplines. Participation in the first Institute will enable Residents to experience a civics-focused STEM-C unit and build their capacity to include a civics-focused STEM-C unit in their LEA clinical placement during the following academic year. As a capstone experience, the Residents participate in the same Institute the following summer as part of the lead teacher group. Residents will thus begin their program as a pre-teacher candidate and finish as a teacher leader for the incoming cohort of residents, as well as their respective LEA districts.

For the civics dimension of the Institute, the Citizen Scientist Residency Pathway will partner with the Kegley Institute of Ethics and the CSUB Department of Teacher Education to develop curricular and pedagogical experiences that center on social-emotional, ethical, and democratic competencies. Residents will practice honing their ability to engage students in cooperative work on common STEM-C projects that focus on community issues in Kern County, to facilitate deliberative dialogue with students to find solutions to address those identified issues, and to provide mediums for students to engage their political voice. These social-emotional, ethical, and democratic competencies will focus on what Residents teach, how they teach, and why they teach. The STEM-C dimension of the Institute will then prepare Residents to explore civics in the context STEM-C education, with an emphasis on helping middle and high school students develop digital civic infrastructure in partnership with scientists from the community to address issues of public concern and hone their political voice.

In terms of the sequence of the Institute, each day of week one will be composed of a morning session in which Residents will observe LEA mentor teachers and IHE content area specialists in teacher education and STEM-C, and an afternoon session in which Residents, LEA mentor teachers, and IHE content-area specialists engage in knowledge and skill building

regarding civics-focused STEM-C curricula and pedagogy. These afternoon sessions will also include coaching sessions in which Residents will participate in cycles of reflection and revision following their observations. For each day of week two, Residents will begin co-teaching with the LEA mentor teacher and content area specialists during the mornings, and the afternoon sessions will again be composed of knowledge, skill and knowledge building, and reflection and revision activities. During the final week, Residents, mentor teachers, and content-area specialists will work together to develop a civics-focused STEM-C unit to integrate into their respective classrooms during the following school year. During this final week, Residents, mentor teachers, and content-area specialists will also be presented with the civics-focused STEM-C elective course and tasked with providing feedback based on their knowledge of Kern County and local conditions at their schools.

Year-long Civics-focused STEM-C Clinical Coaching. To help Residents translate their learning from the Citizen Scientist Institute into their respective LEA district classrooms in ways attuned to the needs of rural and urban communities served by the partnering LEAs, the Citizen Scientist Residency Pathway will curate a team of IHE faculty in teacher education and computer science, LEA science specialists, and mentor teachers to engage in cycles of observation, reflection, and revision with the Residents in their respective LEA classrooms. In particular, the curated Citizen Scientist Residency Pathway coaching team will help residents hone their ability to facilitate civics-focused STEM-C curricula and pedagogy, as well as understand and implement empirically-based practice and scientifically valid research related to the effective use of technology, instructional techniques, and strategies consistent with the principles of universal design for learning, and through positive behavioral interventions and support strategies to improve student achievement.

Coaches will ensure Residents understand and implement student learning methods; analyze student academic achievement data and use such data to improve classroom instruction; meet the specific learning needs of all students, including students with disabilities, students who are limited English proficient, students who are gifted and talented, and students with low literacy levels; differentiate instruction for all students; and effectively participate as a member of the individualized education program team, as defined in section 614(d)(1)(B) of the Individuals with Disabilities Education Act (IDEA), as well as Student academic achievement standards and academic content standards under section 1111(b)(1) of the ESEA. These intensive levels of differentiation will be introduced at the Citizen Science Institute (Launch) as Residents engage with clinically-based exemplars of high quality, empirically-based differentiation and will be part of a sustained conversation with their coaches throughout the year-long coaching experience. Residents will ultimately be expected to model high-quality, empirically based differentiation for the incoming cohort of Residents during their Citizen Scientist Institute (Launch) and the outgoing cohort's Citizen Scientist Institute (Capstone). These dimensions of research-based teaching practices will also be tightly connected to the Residents' coursework in each of their respective methods courses.

STEM-C Digital Civics Infrastructure Unit. One of the main products of the civics-focused STEM-C coaching will be a STEM-C Digital Civics Infrastructure Unit that the Residents will develop and facilitate under the guidance of the Citizen Scientist Residency Pathway coaching team. Each unit will integrate the 2018 California Computer Science Education Standards and address real issues that are impacting Kern County. For example, Kern County is one of the most air-polluted cities in the United States and this had led to increased rates of childhood asthma and cardiovascular disease. On "bad air days," school children are not

allowed to go outside for recess or PE and teachers are not allowed to use the outdoors as an extension of their classroom. One unit developed by the content-expert team will address the air pollution in Kern County and engage students as storytellers, problem solvers, and civic agents as they learn about air pollution, consider existing ways of addressing air pollution, and are challenged to develop digital civic infrastructure to further reduce air pollution. The digital civic infrastructure could include, but is not limited to, digital models that help map the parts of Kern County with the highest particulate matter in the air, apps to track the extent to which citizens are contributing to or reducing air pollution in the community, or video games to teach their peers and fellow citizens about air pollution.

Chief Science Officer Program. A co-curricular enrichment activity will include launching a Chief Science Officer (CSO) program in the region and engaging Residents in the program to build their and students leadership, team-building, and workforce skills. The overarching goals of the CSO program are to 1) empower students' STEM identification, 2) enhance student workforce and employability skills; 3) place youth at the center of STEM advocacy and community action; 4) cultivate a pipeline of diverse STEM leaders; 5) advance K-12 STEM education by leveraging business, higher education and community support in and out of school and building a strong mentoring pipeline; and 6) create a cohesive STEM culture.

For this project, the CSO program will be initiated in Bakersfield City (BCSD), Kern High (KHSD), and Greenfield Union (GUSD) School District schools. Students in grades 6-12 will be elected by their peers to serve as STEM ambassadors for both their schools and community. The backbone organization for the initiative responsible for centralizing program operations will be the Citizen Scientist Residency Pathway Management Team. The team will support the Rainmaker(s) who oversee programmatic (i.e., training institutes, in-field

experiences, collective action opportunities, the Canvas LMS, and best practices) and community (i.e., parents, teachers, school districts, partners, mentors, etc.) support. Key Rainmaker(s) responsibilities include securing startup funding and developing a plan to sustain funding; recruiting schools to engage in the program; identifying community partners as program collaborators and community mentors; building a regional team responsible for (a) organizing and implementing the Leadership Institute, regional events, and cabinet meetings; (b) connecting with CSOs and Residents online via the Canvas LMS; (c) conducting on-site visits to ensure CSOs and Residents are on-track to meet their goals; and d) liaising with the National CSO project team to ensure connectivity and consistency of the program.

Literacy Professional Development. The Citizen Scientist Residency Pathway will improve candidates' and district teachers' knowledge of effective literacy instruction in science and mathematics. Any education in science and engineering needs to develop students' ability to read and produce domain-specific text. As such, every science or engineering lesson is, in part, a language lesson, particularly reading and producing the genres of texts that are intrinsic to science and engineering (NRC Framework, 2012, p. 76). Academic Literacy strategies focus on best practices in vocabulary instruction and writing to improve content knowledge and retention of scientific and mathematical information.

Literacy training will be offered by the CSU Center for the Advancement of Reading and Writing (CAR/W) as outlined below. The Center serves the California State University system in its work preparing outstanding literacy educators for the P-14 schools. The Center facilitates faculty communication and research; disseminates research and policy information; fosters connections among the CSU literacy faculty, P-12 partners, and public education stakeholders; and serves as a forum for the interchange of public and academic interests. Most recently, the

Center's co-directors served as lead authors of the new *California English Language Arts/English Language Development Framework*, which supports teachers in their implementation of California's CCSS in English Language Arts/Literacy and English Language Development Standards.

The Center will sponsor activities designed to strengthen the literacy teaching skills of prospective elementary and secondary school teachers: (A) To implement literacy programs that incorporate the essential components of reading instruction. The Center will conduct training sessions based on the needs of the program several times a year for the duration of the grant. Individuals involved in coursework (i.e., faculty) and clinical experiences (i.e., K-12 CMTs and Faculty Mentors) will participate alongside Residents in the sessions so that Residents' academic learning and field experiences are integrated and strengthened. Sessions will provide participants with a richer understanding of the theoretical underpinnings and research bases of each of the aspects of literacy identified in the table. The Center will address the roles, development, assessment, and systematic instruction for each topic. Furthermore, implications for English Learners and struggling/striving readers will be addressed in depth; (B) To use screening, diagnostic, formative, and summative assessments to determine students' literacy levels, difficulties, and growth in order to improve classroom instruction and improve student reading and writing skills; (C) To provide individualized, intensive, and targeted literacy instruction for students with deficiencies in literacy skills; and (D) To implement literacy skills in the classroom across subject areas.

Assessment and research-based intervention practices regarding each of the topics in (A) above will be included in training sessions. Residents will develop a breadth of understanding about the purposes, strengths, and limitations of a variety of assessments, including screening

and diagnostic instruments to determine students' literacy levels, strengths, and areas of difficulty; formative assessments tied to the curriculum; and summative assessments at the classroom, district, and state levels. Prospective teachers will work in teams with CMTs and university faculty to review data and determine appropriate classroom instruction (including individualized, intensive, and targeted intervention) to improve all students' literacy.

(D) To integrate literacy skills in the classroom across subject areas. The Center will convene campus teams to identify and disseminate effective processes for engaging prospective teachers in high-quality course and clinical experiences in which discipline-specific literacy is addressed across subject areas and in support of students' achievement of the CCSS Standards for Literacy in History/Social Studies, Science, and Technical Subjects. Teams will include subject matter university faculty, who will enhance the literacy practices in their own subject matter university courses, and teacher preparation faculty and field supervisors, who will mentor prospective teachers.

Formative and summative evaluations of the literacy component of the TQP grant will be conducted annually. All participants will complete surveys of their knowledge and skills. Faculty will review Reading Instruction Competency Assessment (RICA) and California's newly revised Teaching Performance Assessment (CalTPA) data, as well as CSU system wide data on prospective teachers' level of preparedness to teach literacy. Subsequent training sessions and meeting topics will be adjusted to reflect identified areas of need.

Citizen Scientist Residency Pathway Goal Two. Sustain a pipeline of credentialed teachers who are committed to teaching civics-focused STEM-C curricula in high needs school districts by creating tailored recruitment, retention, and induction processes.

The quality and sufficiency of strategies for ensuring equal access and treatment for eligible project participants who are members of groups that have traditionally been underrepresented based on race, color, national origin, gender, age, or disability.

Recruitment. The Citizen Scientist Residency Pathway will work closely with IHE faculty in teacher education and STEM-C, as well as LEA science specialists and district leaders, to develop a recruitment campaign for prospective STEM-C teachers who are interested in teaching in the LEA districts. With the hope of recruiting cohorts of Citizen Scientist Residency Pathway teachers who reflect the diversity of the students and families served by our LEA district, the Citizen Scientist Residency Pathway will work with the campus community to recruit teachers identifying as Hispanic/Latino, Mexican, and multilingual. Given the underrepresentation of women in STEM-C fields, the recruitment campaign will include an awareness component regarding both the need for women in STEM-C fields, as well as the potential of women in STEM-C fields.

According to the Stanford Center for Opportunity Policy in Education (2011), teachers who are less qualified by every measure - credentials, subject matter background, pedagogical training, selectivity of college attended, test scores, or experience— tend to serve in schools with a higher percentage of low-income and minority students. The Citizen Scientist Residency Pathway addresses this issue by helping to recruit a high-performing cohort of residents with a vested interest in serving in our high needs partnering districts as part of the residency and through a commitment to teach in our high-needs district following the completion of the Residency program. Recruitment and outreach activities will target undergraduate students, community college students, and career changers. A strategic approach will be developed to

attract candidates who have ties to our partnering school districts, as well as teachers who are underrepresented in STEM-C fields, such as women and people of color. Invoking the principle of cultural synchronicity, which speaks to the personal and academic benefits of minority students being taught by minority teachers (Villegas & Irvine, 2010), a second layer of recruitment will also actively seek candidates who reflect the demographics of our student population.

Candidates will also be recruited specifically from CSUB's undergraduate programs including STEM and liberal studies programs. CSUB's diverse student population makes an excellent candidate recruitment pool. In the Liberal Studies program at CSUB, there are roughly 600 students, half of which are Hispanic. Recruitment efforts will target Liberal Studies students with an interest and aptitude for STEM. The Citizen Scientist Residency Pathway Residency will host bi-monthly orientation sessions open to the community and undergraduate students. As CSUB provides the only Multiple Subject

In addition to CSUB's traditional credential program admission requirements, the partnering Residency Programs will ensure rigorous selection procedures and service obligation. Admission requirements include: 3.0 GPA; Passing score (TBD) on the Learning Mathematics for Teaching (LMT) or Next Generation Science Standards (NGSS) practice test; 500 word Essay; Interview with CSUB faculty, LEA administration and staff; and Passage of the California Basic Educational Skills Test (CBEST) and California Subject Examination for Teachers (CSET). Residents will be chosen based on selection criteria deemed appropriate and required to complete a service agreement outlining residency requirements. The service agreement will explain the commitment after the Residency to work in a rural high-need school.

If the Resident does not fulfill service obligations, the partnership will request the Resident repay the stipend offered by the Kern Urban Teacher Residency, Kern High School District Residency or Greenfield Teacher Residency.

Retention. Nationally, up to 20% of teachers in high needs schools leave each year and up to 50% leave within 3 years (NCTR, 2015). To address this turnover, The Citizen Scientist Residency Pathway will partner with NCTR to create tailored retention programming for each Residency and common programming for retention issues experienced across our Residencies throughout the five years of federal funding and beyond. Residency programs who are part of the NCTR Network report a 92% one year retention rate and an 86% three-year retention rate (NCTR, 2015). Further, residency programs report that 92% of teacher candidates are hired by a Title I school and 94% are hired by a partner district. In terms of the level of preparation, 77% of teachers across the United States report that they were unprepared to teach on Day 1, while more than 90% of residency graduates reporting being prepared to teach on the first day of school (NCTR, 2015). Through NCTR (2015) policy recommendations for effective partnership and collaboration, rigorous recruitment and selection of Residents and high-quality mentors, coaching and feedback for both Residents and mentors, and an assessment system to ensure continual improvement in the supports and professional development offered to both Residents and mentors, the Citizen Scientist Residency Pathway strives to meet or exceed the one year and three year retention rates achieved by NCTR support teacher residency programs.

Induction. In California, there is already a rich induction program for all new teachers. In order to move their credential from preliminary status to clear status, every new teacher must participate in a two-year induction program run by either the district or other approved entity. When a Citizen Scientist Residency Pathway Resident earns their credential and is hired by the

LEA, and as they progress through the Induction Phase program, they will retain their Citizen Scientist Residency Pathway faculty mentor as a support to their transition into the teaching profession by providing content expertise and expertise in teaching. The faculty mentor will be in addition to the induction program provided by the district, in turn creating an induction support team comprised of Induction Phase support provider (KCSOS), faculty mentor, and a CSUB faculty content expert. This team of support will prioritize the use of empirically-based practice and scientifically valid research on teaching and learning.

During the first two years of a full-time teacher's career, the Citizen Scientist Residency Pathway mentors' will focus on the establishment of a community of practice within each of the participating LEAs. So as not to overburden the new teacher, the induction support mentor will partner with the existing Induction Phase support they will be already receiving. The goal of the Citizen Scientist Residency Pathway induction support faculty mentor will to act as a bridge from the Citizen Scientist Residency Pathway year long clinical experience to the first two years of teaching experience. They will continue to support the growth of the new Citizen Scientist Residency Pathway teacher through specific leadership professional development and connect the new teacher with Citizen Scientist Residency Pathway Residents. There is evidence that this type of peer partnership and professional collaboration will have a positive effect on the Resident's and the new teacher's ability to close the achievement gap (Trautwein & Ammerman, 2010). Each of the continuing Citizen Scientist Residency Pathway mentors will engage in ongoing training and support related to their mentor-specific roles and responsibilities, and each Citizen Scientist Residency Pathway mentor will receive release time, if they are a faculty member at CSUB, or a stipend, if they are part of the LEA district. To continue to build STEM-C competencies and enhance professional standing, Citizen Scientist Residents will have the

opportunity to earn a supplementary authorization in computer science during their two year Induction Phase.

The new teacher and the faculty mentor will use social media and other internet based collaboration tools as a large part of the post credential support. Monthly video conference sessions with other graduates of the Citizen Scientist Residency Pathway program will give the new teachers an avenue to share stories of success, areas of frustration, and have a general question and answer opportunity. Social networking technology will be developed as an informal way for the new Citizen Scientist Residency Pathway teacher to collaborate with others from the project. A Twitter or similar type account will be created in order for new teachers to have instant access to mentors and fellow new teachers. This will support and continue the idea of distribution of cognition where the cohort as a group benefits more than as separate individuals. All the previous mentors that supported the new teacher on their journey from Resident will also be part of the social media experience.

Mentoring. Mentors are an essential component to the Citizen Scientist Residency Pathway. Research has shown that when mentors are a part of the clinical experience, Residents increase their efficacy rates, as well as their abilities to help their students meet academic standards (Hobson, Harris, Buckner-Manley & Smith, 2012; Zeichner, 2010). During the course of the Citizen Scientist Residency Pathway, Residents will have access to four mentors who will work collaboratively to support each Resident. Each Citizen Scientist mentor team will be composed of two IHE faculty mentors (one from a STEM-C content field and one from teacher education with specialization in science pedagogy) and two LEA mentors (a district science-specialist hired by the Citizen Scientist Residency Pathway and a cooperating teacher mentor/CTM). This team of mentors will work collaboratively over the course of the civics-

focused STEM-C residency pathway to coach teacher candidates to facilitate research-based, high leverage practices to improve student achieve in STEM-C and increase their participation in the civic life of the community.

The LEA and Faculty mentor will be selected through an application process by the management team during the launch year of the Citizen Scientist Residency Pathway. To compensate mentors for their time, IHE faculty mentors will receive course workload credit and LEA mentors will receive a stipend. During the residency a CSUB TED faculty or STEM-C content faculty will be engaged each week with the LEA sites. They will work directly with the Residents and cooperating teacher mentors (CTM) either through assessment of the process (C3), modeling lessons, co-teaching (with the Resident or the CTM), or debriefing with students at the end of the day. The site's faculty mentor will coordinate these visits with the LEA mentor. The LEA mentor will act as liaison between the LEA and the University, provide co-teaching support, and be an active part of the observation/evaluation process. The LEA mentor will work with the Residents to provide information on school culture, school logistics and the community. The LEA mentor and the IHE faculty mentor will work in partnership to brainstorm and plan differentiated professional development for the Residents, CTM, and the LEA stakeholders.

Citizen Scientist Residency Pathway Goal Three. Co-create and co-implement curriculum and multi-stakeholder structures for professional development that support teacher leaders, site administrators, superintendents, and university faculty's use of research-based best practices in the domains of teacher recruitment, retention, and induction, with an emphasis on the intersections of STEM, civics, and computer science teaching and learning.

Civics-focused STEM-C Curricular and Pedagogical Development. Given the lacuna in literature regarding best practices in civics-focused STEM-C curricula and pedagogy, the Citizen Scientist Residency Pathway will, in part, use the design-year of the grant to bring together content area experts in the fields of civics, education, and STEM, with an emphasis on computer science, to develop innovative curricula and pedagogy that integrates research-based pedagogical practices in the respective fields and aligns content to state and national standards. The result will be a series of unit plans that Residents and LEA districts can use as a way to scaffold the infusion of civics-focused STEM-C education in K-12 classrooms, as well as the redesign of the literacy, social studies, math, and science methods courses within the Residency programs and throughout the traditional teacher education program. The sum of these units will comprise the curriculum and pedagogy of a Citizen Scientist Elective Course, which is described below. During the design year, elements of the curriculum and pedagogy development by IHE faculty experts and LEA instructional specialists will be piloted with existing Residents in the Bakersfield City School District's Kern Urban Teacher Residency, the Kern High School District's Kern High Teacher Residency, and the Greenfield Union School District's Kern Teacher Residency - Greenfield.

STEM-C Digital Civics Elective Course. The same Citizen Scientist Residency Pathway curriculum and pedagogical development team comprised of IHE faculty in computer science, STEM, and teacher education, as well as LEA mentor teachers and science-specialists will create a STEM-C curriculum to be taught in either a makers-space (3-8 classroom) or STEM-C elective course (6-8 sites). The Citizen Scientist Residency Pathway Course will be piloted during year two of the grant at one of the LEA school sites and then be scaled to the other LEA school sites and districts through either their after school programs or as an elective course. Ultimately, the

Citizen Scientist Residency Pathway course will be designed with the hope of scalability throughout the LEA school districts in the years following the funding years of the grant with management and funding fully transitioning to the LEA districts.

Civics-focused STEM-C Instructional Assessment Protocol. In response to call in our LEA districts to create a science-specific classroom observation protocol, the interdisciplinary team of IHE and LEA content area experts in the fields of civics, education, and STEM-C will develop a civics-focused STEM-C Instructional Assessment Protocol or Citizen Scientist Instructional Assessment Protocol to be used by Citizen Scientist mentor teams as they engage in coaching cycles with the Residents. The Instructional Assessment Tool will be aligned to current State Standards and reflective of research-based curricular and pedagogical practices in the fields of civics and STEM-C, with an emphasis on their intersections. Following piloting in the LEA districts, the Citizen Scientist Instructional Assessment Protocol will be further field tested to ensure sustainability and scalability within and beyond the federal financial assistance period.

Professional Development for Recruitment, Retention, and Induction, with an Emphasis on Civics-Focused STEM-C Teaching and Learning. Citizen Scientist Residency Pathway will support existing school-site leaders, administrators, superintendents, LEA district specialists, and IHE faculty by providing calibrated, research-based professional development through in-person, web-based, and hybrid technology. The professional development will be co-created and co-implemented with the Citizen Scientist Residency partners and will integrate research-based, high leverage practices for student achievement; teacher recruitment, retention, and induction; the content areas of civics, STEM, and computer science; and the capacity building needed to develop and sustain high quality civics-focused STEM-C curriculum, pedagogy, assessment, and related programing at the end of the federal assistance period.

Citizen Scientist Residency Pathway Partners

The extent to which the services to be provided by the proposed project involve the collaboration of appropriate partners for maximizing the effectiveness of project services.

The Citizen Scientist Residency Pathway will focus on high need K-12 schools that contain high percentages of students on free or reduced lunch, English Language Learners, and minority populations through a partnership with Institutions of Higher Education (IHE): California State University, Bakersfield (CSUB) Department of Teacher Education, CSUB Department of Computer and Electrical Engineering and Computer Science; Local Educational Agencies (LEA): Bakersfield City School District (BCSD), Kern High School District (KHSD), and Greenfield Union School District (GUSD); LEA Residencies: Kern Urban Teacher Residency, Kern High Teacher Residency, and Kern Teacher Residency – Greenfield; and Community Partners: Kegley Institute of Ethics and Arizona SciTech and the Chief Science Officer Program (Figure 1). Each partner brings unique resources, including grant funds, financial support, supplies, technology, and expertise. These resources will help to sustain the program after funding ends. LEAs have afterschool and summer funding models that will support the integration of STEM into the curriculum. LEAs will also provide staff and administrator time to the project at no cost to the grant. The partnership will also continue to apply for grants to support the goals of the project. A description of each partner and their relative context is outlined here.

Eligible IHE Partners

Figure 1. Citizen Scientist Residency Pathway Partners

LEA District Partners	Kern High School District; Greenfield Union School District; Bakersfield City School District
Residency Partners	Kern High Teacher Residency; Kern Urban Teacher Residency; Kern Teacher Residency- Greenfield
IHE Partners	CSUB Department of Teacher Education; CSUB Department of Computer and Electrical Engineering and Computer Science
Community Partners	Kegley Institute of Ethics; Arizona SciTech and the Chief Science Officer Program

CSUB is a diverse Hispanic Serving Institution (HSI), over 60% of students are underrepresented minorities and nearly 2/3 of students enrolled at CSUB are first-generation college students. Almost 70% of CSUB’s 50,000-plus alumni live and work in CSUB’s service region. CSUB serves a large rural and urban area and is the only four-year public institution of higher education within a 100-mile radius of Bakersfield. Although Kern County struggles to produce Hispanic post-baccalaureates (less than 1% have a post-baccalaureate degree), CSUB has made considerable strides in recruiting a diverse undergraduate body. As of fall 2017, 55% of undergraduates and 46% of post-baccalaureates are Hispanic (CSUB IRPA, 2017). CSUB maintains full accreditation by the Senior College Commission of the Western Association of Schools and Colleges (WASC).

The School of Social Sciences & Education is the largest of the four schools at CSUB and within the school, the **Department of Teacher Education** offers preliminary credentials in multiple subject and single subject. In the 2016-2017 academic year, CSUB’s teacher preparation program had 222 program completers (CSUB, 2017). All programs are accredited

by the Council for the Accreditation of Educator Preparation (CAEP) and meet all California Commission on Teacher Credentialing (CTC) requirements. On the most recent CTC Annual Report Card on California Teacher Preparation Programs for the Academic Year 2016-2017, CSUB received summary pass rate for program completers of 96% (CTC Report Card, 2017). Passing competencies indicate CSUB is classified as one of the highest-performing teacher preparation programs in the State (State Report Card under section 205(b) of the HEA). Each student in the program is required to meet high academic standards and demonstrate a record of success in order to matriculate into, stay in good standing with, and complete each credentialing program, which is composed of both rigorous coursework and intensive clinical experience. To complete the program, each student must meet all state certification and licensure requirements.

The Department of Teacher Education at CSUB has been impacted in very significant and positive ways as a result of TQP funding. The current TQP-funded Kern Rural Teacher Residency program has prepared more than 80 multiple subject teachers in year-long clinical preparation with highly trained mentor teachers. The credential program coursework has been transformed to include multiple opportunities for candidates to learn, practice, and apply the California Content Standards including the Common Core Standards, the Next Generation Science Standards, and the English Language Development Standards. Residents participate in high-quality clinical experiences both in the three partner districts and in the summer Camp Blast! experience with 500 elementary students engaged in STEM.

The CSUB **Department of Computer and Electrical Engineering and Computer Science** (CEE/CS) offers bachelor of science degrees in Computer Science (CS), Computer Engineering (CE), and Electrical Engineering (EE). The CS program is most relevant to the

proposed activities. In the 2016-17 academic year, CEE/CS had 273 CS majors and awarded 26 CS degrees (CSUB, 2017). The CS degree program is designed to meet the ACM 2013 CS Curriculum Guidelines, which provides students with a broad foundation in computing principles and prepares them for a wide range of careers in computing and technology. CEE/CS faculty have been involved in a variety of engineering and computer science educational efforts, including multiple U.S. Department of Education Minority Science and Engineering Improvement Program (MSEIP) grants, multiple U.S. Department of Education Title V Hispanic Serving Institutions grants, a National Science Foundation Improving Undergraduate STEM Education grant (IUSE), and in outreach to high school students through CSUB's REVS-UP summer research experience.

Eligible LEA School District Partners

For all three of our partnering school districts, **Bakersfield City School District (BCSD)**, **Kern High School District (KHSD)**, and **Greenfield Union School District (GUSD)**, school is one of the main centers of community life. Each district is located in Kern County, the heart of the California's Central Valley and one of the most productive agricultural regions in the country with a large migrant population. Kern County is home to over 893,000 people and, according to data from the U.S. Census Bureau (2017), 52.8 percent of the population identifies as Hispanic as compared to the national average of 17.8 percent. Kern County is also one of California's neediest regions with 22.4 percent of the total population living in poverty as compared to a 14.3 percent poverty rate throughout California (U.S. Census Bureau, 2017). As of April 2018, the unemployment rate in the Kern County is 8.3 percent (Employment Development Dept., 2018). This compares with an unadjusted unemployment rate of 3.8 percent for California and 3.7 percent for the nation during the same period (Employment Development

Dept., 2018). The following sections share data regarding the ways in which each school district meets the poverty requirement for the district and the teacher need requirement.

Without highly trained teachers and the retention of properly trained teachers, our partnering LEA districts are at a reduced capacity to close the opportunity gaps that limit students' learning and life chances in Kern County. In addition to test scores that are vastly lower than state and national averages, the students often come to school with high social and emotional needs due high poverty conditions and the challenges and opportunities inherent to being an English Language Learner, as well as increased health challenges due to the poor air quality in the region. The Citizen Scientist Residency Pathway seeks to do more than simply teach students competencies in STEM-C education. Whether we recognize it or not, children are spending years of their lives in schools internalizing educators' values, our visions of what matters—and how they matter. Each day that teachers are silent about community issues in the classroom, children learn to be silent. Each day that teachers do not engage students as active civic agents, children learn to be passive subjects of laws they cannot yet vote to change. The Citizen Scientist Residency Pathway encourages teachers to engage children as storytellers, problem solvers, and civic agents in the context of real community issues as they apply STEM-C competencies to address the lived issues in Kern County that impact their lives.

Bakersfield City School District: Needs Assessment. Of the 30,372 students enrolled in the BCSD during the 2016-2017 school year, 88.9% qualify for Free or Reduced Lunch (Ed-Data). Of Bakersfield City School District's 1526 teachers during the 2016-2017 school year, 367 or 24%, were practicing without a full credential (District Data). Based on California Assessment of Student Performance and Progress (CAASPP) and the 2016 California Standards Test in Science (CST-Science), 33.3 percent of students are at or above proficient in

ELA/Literacy, 23% are at or above proficient in mathematics, and 25 percent of 5th graders and 42 percent of 8th graders are at or above proficient in science. At one BCSD high-need school, Fremont Elementary, 98% of the students qualify for free or reduced lunch and 85.9% identify as Hispanic/Latino.

Kern High School District: Needs Assessment. Of Kern High School District's 39,081 enrolled student population during the 2017-2018 school year, 68.9 percent qualify for Free or Reduced Lunch (CALPADS). Currently, the Kern High School District has a high percentage of teachers with emergency, provisional, or temporary certification or licensure. Specifically, out of 1800 teachers, 153, or 8.5 percent, are practicing without a full credential (District Data). Based on 2016-2017 CAASPP and the 2016 California Standards Test in Science CST-Science results, 51.3 percent are at or above proficient in ELA/Literacy, 21.4 percent are at or above proficient in mathematics, and 56 percent of 10th graders are proficient in Life Science. At one KHSD high-need school, Mira Monte High School, 90.5% of the students qualify for free or reduced lunch and 89.4% identify as Hispanic/Latino.

Greenfield School District: Needs Assessment. As of the 2017-2018 school year, 86.7 percent of students throughout Greenfield Union School District qualify for free or reduced lunch (District Data). Currently, the Kern High School District has a high percentage of teachers with emergency, provisional, or temporary certification or licensure. Specifically, out of 451 teachers, 45, or 9.9 percent, are practicing without a full credential (District Data). Based on 2016-2017 CAASPP and the 2016 California Standards Test in Science, 42.3 percent are at or above proficient in ELA/Literacy, 32.4 percent are at or above proficient in mathematics, and 49 percent of 5th graders and 54 percent of 8th graders are at or above proficient in science. At one GUSD high-need school, Fairview Elementary, 97.7% of the students qualify for free or reduced

lunch and 90.8% identify as Hispanic/Latino.

Residency Partners

The **Kern Urban Teacher Residency** and the **Kern Teacher Residency-Greenfield** are teacher preparation programs for graduate students seeking to earn their multiple-subject teaching credential, as well as a single-subject add-on credential in some cases. In both residency programs, there is a deep partnership between the university and the district, and the highly trained residents become teachers in their respective district upon successful completion of the residency program. This program is a classroom-based clinical experience in which residents are placed in year-long clinical practice. Residents learn from, practice with, and execute lessons alongside a carefully selected, highly qualified Mentor Teacher. Credential program coursework is co-taught with university faculty and district instructional specialists ensuring clear alignment for the residents.

The **Kern High Teacher Residency** program prepares candidates who are seeking a single subject credential in all content areas. This partnership between the CSUB and the Kern High School District was developed in 2018 to sustain and scale the work of the current TQP-funded Kern Rural Teacher Residency Program. Single Subject Credential candidates complete a full year of co-teaching clinical practice with highly trained mentors. Their credential program coursework is co-taught with university faculty and district instructional specialists. Residents are provided with calibrated feedback on pedagogy from both the university faculty and the district mentors throughout their clinical practice.

Kegley Institute of Ethics

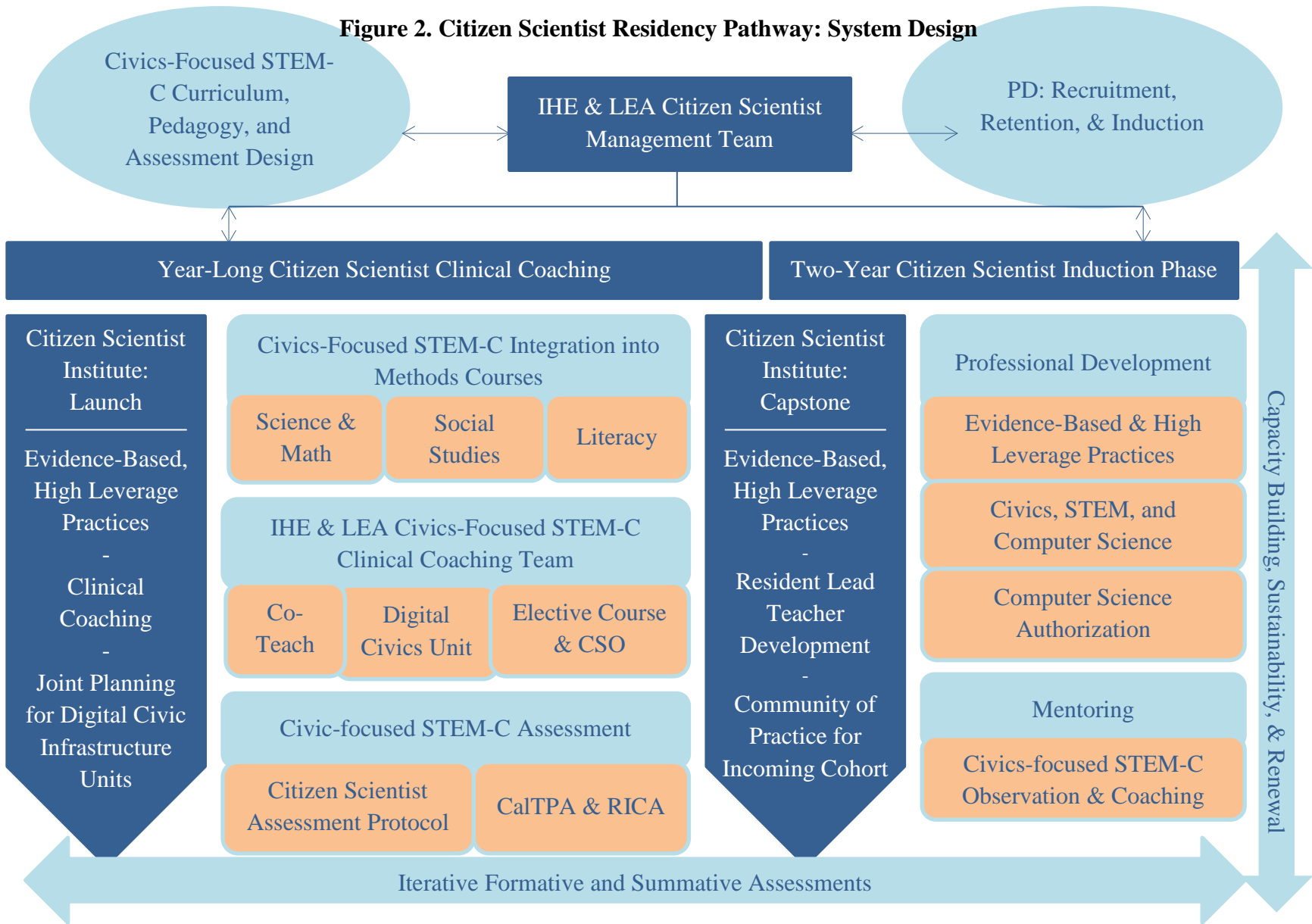
The **Kegley Institute of Ethics** (KIE) programming and initiatives reach several thousand campus and community members each year. They are committed to serving our

campus and community through ethics education, research, and practice. To this end, the KIE hosts a bi-annual speaker series on timely ethical issues – ranging from human trafficking and poverty to free speech, global warming, and issues of social justice (among many other topics) – as well as several ethics discussion panels and events each year for our faculty, students, and community members. In addition, the KIE provides ethics education resources and training for local teachers, as well as ethics consulting for local hospitals, police, prisons, and community organizations. Through the Ethics Across Campus Program, the KIE also provides training and funding support for CSUB faculty members to introduce ethics to students across the University.

Arizona SciTech and the Chief Science Officer Program

The CSO program, modeled after student government, empowers 6-12th grade students to take leadership roles in championing STEM awareness and engagement on and off campus. CSOs work with school administrators and points of contact to plan and implement STEM engagement opportunities that reflect their peers' interests. They streamline connections to local scientists, professionals, and organizations, working with these entities to offer their peers and community members hands-on experiences that build STEM awareness and 21st Century workforce skills. CSOs also function as a unified "cabinet," engaging in local, state, national, and international STEM conversations to change the perception of STEAM (including the Arts); transform school and community culture; and broaden participation for all students and community members.

Figure 2. Citizen Scientist Residency Pathway: System Design



Quality of Project Management Plan

The adequacy of the management plan to achieve the objectives of the proposed project on time and within budget, including clearly defined responsibilities, timelines, and milestones for accomplishing project tasks.

The Citizen Scientist Residency Pathway envisions broad and significant improvements to teacher education as it is conducted for Residents of CSU Bakersfield in conjunction with three high-need LEA districts in Kern County. In recognition of the scope and complexity of this undertaking, we developed a project management structure and operations intended to achieve all the goals, objectives, and outcomes of the project and to meet all statutory reforms and improvements stipulated in the TQP grant application. Towards these ends, the Citizen Scientist Residency Pathway Management Team has three core committees. The **Executive Committee (EC)** will facilitate collaboration, oversee processes, and review inputs and outputs to ensure implementation fidelity and achievement of intended outcomes for *Goal One: Civics-Focused STEM-C Pathway*. The Executive Committee will be composed of the PI, Co-PI, IHE Faculty Experts, LEA instructional specialists, and representative LEA Mentor Teachers. The **Teacher Recruitment, Retention, and Induction Committee (TRRIC)** will support *Goal Two: Recruitment, Retention, and Induction* and will be composed of representative IHE Faculty Mentors, LEA Mentors, Educational Coordinator, and representatives of recent graduates as new teachers. The **Curriculum and Professional Development Committee (CPDC)** will support *Goal Three: Curriculum and Professional Development* and be composed of IHE faculty experts, LEA representatives, and teacher candidate representatives.

The Executive Committee will meet on a bi-weekly basis to assess status, identify and address barriers to implementation, and calibrate policies and operations, when necessary, to ensure progress and achieve milestone objectives. The Curriculum and Professional Development Committee will work closely with local partners at each of the implementation sites with monthly progress meetings to review inputs, outputs, and outcomes, to identify and address needs, and to ensure consistency and fidelity in achieving common milestones and objectives. Similarly, the Teacher Recruitment, Retention, and Induction Committee will work closely with local partners at each of the implementation sites with monthly progress meetings to review inputs, outputs, and outcomes; and to address needs to ensure consistency and fidelity in achieving milestones and objectives. An annual Citizen Scientist Residency Pathway Management Council Meeting will be held in conjunction with the Citizen Scientist Institute. The Management Council Meeting will (1) review policies, operations, and qualitative and quantitative data to ensure accountability, (2) refine strategies and practices to address needs of Citizen Scientist partners and ensure continuous improvement, and (3) share findings and implications to build capacities for scalable and sustainable improvement.

Timeline, Milestones, and Responsibilities

Our five year plan includes a **Design Year** (Year 1), **Launch Year** (Year 2), two **Revision and Renewal Years** (Years 3-4), and a **Revision, Renewal, and Transition Year** (Year 5). Table 1 offers a zoomed in approach to year one, the design year, and Figure 3 shares specific timelines, milestones, and responsibilities throughout the federal assistance period. Below we also share the qualifications of key personnel and their roles in project management.

The adequacy of support, including facilities, equipment, supplies, and other resources, from the applicant organization or the lead applicant organization.

Dr. Brittney Beck will serve as Principal Investigator (PI) and oversee the Citizen Scientist Residency Pathway processes, programs, and operations. She is an Assistant Professor in the Department of Teacher Education at CSUB. Dr. Beck has over 10 years of experience building the capacity of school-university-community partnerships through innovative, interdisciplinary multistakeholder program design and implementation. She currently serves as a Kegley Institute of Ethics Fellow; Mathematics Methods Fellow with TeachingWorks; and an Improvement Research Fellow with WestEd. Dr. Beck is lead author and researcher for the Citizen Scientist Project research and development agenda. With teaching and research expertise at the intersections of civic and STEM education, she works to engage K-12 students, especially those from marginalized backgrounds, as storytellers, problem solvers, and change-makers by organizing state and national standards around real community issues. Dr. Beck will devote 60% of her time and will be responsible for ensuring goals and outcomes are met on time and within budget, as well as for co-developing and co-implementing civics-focused STEM-C curriculum, pedagogy, and assessment. Dr. Beck will also serve as Chair of the Executive Committee, ensuring the alignment and quality of each dimension of the Citizen Scientist Residency Pathway.

Dr. Michael Burroughs will serve as Co-PI and assist with overseeing Citizen Scientist Residency Pathway processes, programs, and operations. He is an Assistant Professor in the Department of Philosophy and the Director of the Kegley Institute of Ethics. Dr. Burroughs is an expert in child philosophy and has developed several in and out of school programs to help engage children in philosophical conversations regarding issues of public concern. He will devote 20% of his time and will be responsible for ensuring goals and outcomes are met on time

and within budget, as well as for co-developing and co-implementing civics-focused STEM-C curriculum, pedagogy, and assessment.

Dr. Melissa Danforth and **Dr. Alberto Cruz** will serve as Citizen Scientist Residency Pathway key personnel and system-level academic innovation experts in STEM-C. Dr. Danforth is a Full Professor and Department Chair of the Computer and Electrical Engineering and Computer Science Department at CSUB and Dr. Cruz is an Assistant Professor in the the Computer and Electrical Engineering and Computer Science Department at CSUB. They have extensive experience working with STEM and computer science education at both the K-12 and higher education settings through programs such as Project Lead the Way, REVS UP, and self-created programming to foster retention of minority students in STEM-C fields. They will each devote 20% of their time and will be responsible co-developing and co-implementing civics-focused STEM-C curriculum, pedagogy, and assessment, as well as serving as content-area experts on the Citizen Scientist Residency Pathway year-long clinical coaching teams. Dr. Danforth and Dr. Cruz will also serve as Committee Co-Chairs for the Curriculum and Professional Development Committee, overseeing the development, implementation, and evaluation of curriculum, pedagogy, assessment, and professional development.

Dr. BreAnna Evans-Santiago will serve as key personnel and system-level expert in recruitment, retention, and induction. Dr. Evans-Santiago is an Assistant Professor in the Department of Teacher Education and Next Generations of Educators Initiative Research Fellow in which she has been tasked with fostering continuous improvement for the Bakersfield City School District Kern Urban Teacher Residency Program. She will devote 20% of her time and serve as Chair of the Teacher Recruitment, Retention, and Induction Committee, overseeing the

development, implementation, and evaluation of recruitment, retention, and induction programming.

Building Capacity and Yielding Results Beyond Federal Financial Assistance Period

The potential for the incorporation of project purposes, activities, or benefits into the ongoing program of the agency or organization at the end of Federal funding & The extent to which the proposed project is designed to build capacity and yield results that will extend beyond the period of Federal financial assistance.

Table 1. Citizen Scientist Residency Pathway: Strategies and Activities for Year One Implementation		
Year One	Strategies & Activities	Timeline
<p>Goal One: Civic-Focused STEM-C Pathway</p> <p>Primary Responsibility: Executive Committee</p>	Establish Management Team composed of the Executive Committee; Recruitment, Retention, and Induction Committee; and the Curriculum and Professional Development Committee	S1
	Establish a sustainability baseline using the Sustainability Assessment Tool	S1-3
	Design partnership governance structures to ensure alignment between goals, objectives, activities, strategies, and outcomes.	S1-3
	Develop and Implement Citizen Scientist Institute	S1-3
	Conduct perceptual and impact studies	S1-3
	Create and disseminate semesterly summaries and annual report	S2-3
<p>Goal Two: Recruitment, Retention, and Induction</p> <p>Primary Responsibility: Teacher Recruitment, Retention, and Induction Committee</p>	Develop and implement a recruitment campaign tailored to underrepresented groups in STEM-C fields	S1-2
	Create an instructional support team for each member of the Citizen Scientist Residency Pathway cohort.	S1-2
	Design Citizen Scientist retention and induction phase	S1-3

Goal Three: Curriculum and Professional Development Primary Responsibility: Curriculum & Professional Development Committee S=Semester	Design civics-focused STEM-C curricula, pedagogy, and assessment	S1-3
	Design a civics-Focused STEM-C Assessment Protocol to measure Residents’ ability to implement civics focused STEM-C curricula and pedagogy during the yearlong clinical coaching cycle.	S1-3
	Develop scaffolded professional development for teacher leaders, site administrators, university supervisors, and university faculty on the intersections of civics, STEM, and computer science education.	S1-3
	Develop scaffolded professional development for teacher leaders, site administrators, superintendents, and university faculty on research-based practices for teacher recruitment, retention, and induction, with an emphasis on STEM-C fields.	S1-3

The Citizen Scientist Residency Pathway is designed to build the capacity of and yield results for our LEAs, teacher Residencies, and general single subject and multiple subject teacher preparation programs beyond the federal financial assistance period by engaging the Sustainability Framework outlined by the TQP TA Center. This Framework addresses four core dimensions of an effective sustainability plan: 1) Stakeholder Support and Communication, 2) Capacity for Widespread Use, 3) Financial Support, and 4) Return on Investment. Throughout the federal financial assistant period and in collaboration with are partners, we will use the Sustainability Assessment Tool developed by the TQP TA Center to foster ongoing discussion and action planning regarding how we will have each dimension of the sustainability plan in place by Year Five of the grant. In the sections below, we outline our commitments to lasting change, using the Sustainability Framework as a guide, and, when possible, describe our existing progress towards sustainability.

Stakeholder Support and Communication. We have identified all initial key stakeholders for the grant. Moving forward, we will use the design year to develop regular communication touch points that engage a variety of channels (website, press release,

newsletters, school and district level meetings, etc.) to elicit stakeholder feedback (surveys, focus groups, in-person meetings); sustain discussion about goals, programming, timelines, and milestones; and determine the best approach to communicating with the media. As we establish the modes and frequency of our communication, stakeholders will collaboratively develop documentation in the form of guidebooks to clearly outline how the communication strategy is designed to function. This guidebook will be sent to all relevant stakeholders to inform their respective strategic planning efforts and their interactions with the Citizen Scientist Residency Pathway.

Capacity for Widespread Use. The innovative civic-focused STEM-C curriculum, pedagogy, assessment, and professional development created and revised over the five year federal assistance period will inform lasting changes to each Residency. These changes will also be scaled and translated into our multiple subject and single subject preparation courses and clinical experiences, more broadly. Given that we will be creating a K-12 arch with the integration of the new 2018 California Computer Science Education Standards, the curriculum, pedagogy, assessment, and professional development we create will be shared as a guidepost throughout Kern County and the California. To ensure proper staff, system and infrastructure capacity, ongoing monitoring and evaluation, and alignment to the most important goals and priorities remain in place beyond the federal financial assistance period, the Citizen Scientist Residency Pathway will integrate sustainability measures into the timeline and milestones of the Project to ensure all key staff have the knowledge, skills, and abilities to meet Project demands and that the systems and infrastructure are debugged to smoothly facilitate Project goals and outcomes.

Financial Support. The Kern High School District and the Greenfield Union School District have committed to funding the core components of their respective Residencies within and beyond the federal financial assistance period. Specifically, both KHSD and GUSD have agreed to fund a .5 administrator from the district, mentor teacher stipends of at least [REDACTED] per year, Resident stipends of at least [REDACTED] per year, and will enable LEA district instructional specialists to co-teach courses in collaboration with IHE teacher education faculty. The civics-focused STEM-C curriculum, pedagogy, assessment, and professional development for Residents and mentor teachers, including the summer Institutes, will also continue to be run as a collaborative, cost-sharing effort between the LEAs and IHE Department of Teacher Education, Department of Computer Science, and Kegley Institute of Ethics. The reduction of costs through program modification, resource reallocation, and the continued pursuit of multiple funding sources will be explored to further ensure sustainability of the Citizen Scientist Residency Pathway beyond the federal financial assistance period. The National Center for Teacher Residencies will assist in providing calibrated partnership structures and processes to support the efficacy of the partnership during the grant period and sustainability beyond the grant period.

Return on Investment. Our return on investment plan includes formative and summative assessment co-developed and co-implemented in partnership with WestEd and our Citizen Scientist partners to ensure progress is measured for our short-term, mid-term, and long-term outcomes and that the quantifiable outcomes are of value to our stakeholders, such as equitable access to effective teaching for the students of color and English Language Learners and educator retention within our LEA districts.

Figure. 3: Project Management: Timeline, Milestones, and Responsibilities

Years	Activities/Strategies	Milestones
Year One Design 10/18-09/19	Citizen Scientist Institute Citizen Scientist Instructional Assessment Protocol Civics-focused STEM-C Curriculum & Pedagogy Digital Civics Infrastructure Units Chief Science Officer Program Civics-focused STEM-C Elective Course Recruitment, Retention, Induction Professional Development	<p>Perceptual Studies: Yr. 1: 50%, Yr.2: 75%; Yr. 3: 80%; Yr. 4: 85%; Yr. 5: 90% satisfaction rating across stakeholders</p> <p>Citizen Scientist Instruction Assessment Protocol: Yr. 1: 25%, Yr.2: 50%; Yr. 3: 75%; Yr. 4: 85%; Yr. 5: 100% proficiency rating for Residents and Mentor Teachers</p> <p>RICA/CalTPA: Yr. 1: Design Yr. 2: 25%; Yr. 3: 50%; Yr. 4: 75%; Yr. 5: 85% will pass on the first attempt.</p> <p>Citizen Scientist Curriculum: Yr. 1: Design Yr. 2: 25%; Yr.3: 50%; Yr. 4: 75%; Yr. 5: 85% integration into Resident and mentor teachers’ classrooms</p> <p>Recruitment: Yr. 1: Design Yr. 2: 5%; Yr. 3: 10%; Yr. 4: 15%; Yr. 5: 20% increase in Residents from underrepresented fields in STEM-C</p> <p>Retention: Cohort 1: 60%; Cohort 2: 75%; Cohort 3: 80%; Cohort 4: 85% three year retention rate</p> <p>Student Achievement: Yr. 1: Design; Yr. 2: 1%; Yr. 3: 2%; Yr. 4: 3%; Yr. 5: 5% increase in aggregate scores</p> <p>Sustainability: Yr. 1: 20%; Yr. 2: 40%; Yr. 3:60%; Yr. 4: 80%; Yr. 5: 100% complete based on the Teacher Quality Program Sustainability Self-Assessment Tool</p>
Year Two Launch 10/19-09/20		
Year Three Revise & Renew 10/20-09/21		
Year Four Revise & Renew 10/21-09/22		
Year Five Revise, Renew & Transition 10/22-09/23		

Executive Committee; Recruitment, Retention, & Induction Committee; Curriculum & Professional Development Committee

Quality of Project Evaluation

WestEd, the proposed external evaluator, will use a mixed-methods approach (Teddlie & Tashakkori, 2008) to evaluate the Citizen Scientist Residency Pathway providing both objective- and performance-driven data. WestEd will collect and analyze quantitative data on GPRA, HEA, and the Citizen Scientist Residency Pathway performance measures; on the proposed project goals, objectives and outcomes; and for a Quasi-Experimental Design (QED) assessing whether the Citizen Scientist Residency Pathway results in improved teacher and student outcomes relative to traditional teacher preparation programs. WestEd will compare findings on performance measures for participants of the Citizen Scientist Residency Pathway with national and state standards of excellence in teacher preparation, as well as to the outcomes of other credentialing programs. WestEd will collect and analyze qualitative data to explain quantitative findings and maintain all data in a longitudinal database to assess progress and allow for within- and cross-cohort comparisons.

The extent to which the methods of evaluation will provide valid and reliable performance data on relevant outcomes.

WestEd will collect, analyze, and report on valid and reliable performance data on relevant outcomes. In addition to reporting on relevant GPRA, HEA, and project-based measures, the evaluation will include a study of program implementation and built-in support for continuous improvement to help ensure that implementation efforts are informed by data. Table 2 below presents an aligned plan that includes the project goals and activities, and how the

Table 2. Citizen Scientist Pathway Evaluation Plan	
Project Goals and Objectives	Evaluation Methods and Sources
Goal 1: Develop pathway to increase the capacity of 240 multiple subject credential and 240 single subject credential Residents to design, facilitate, and assess high quality, civic-focused STEM-C pedagogy and curricula in high-needs schools.	
<ol style="list-style-type: none"> 1) Form Project Management Team with Executive Committee; Recruitment, Retention, & Induction Committee; and Curriculum & Professional Development Committee to oversee Citizen Scientist Residency Pathway 2) Develop and launch Citizen Scientist Institute 3) Create year-long clinical coaching cycle to help Residents implement civics-focused STEM-C curricula, pedagogy, and assessment in their LEA classrooms 4) Establish Chief Science Officer Program for middle and high school students at each LEA school site 5) Weave professional development on literacy for STEM-C teaching and learning throughout Citizen Scientist Residency Pathway 6) Recruit Residents in collaboration with partner residencies for Citizen Scientist Residency Pathway 	<ul style="list-style-type: none"> • Program data on one-year persistence rates • Performance on CalTPA, RICA, CSET (number of attempts) • Observation results using the Civics-Focused STEM-C Instructional Assessment Protocol • Surveys and interviews with Residents on quality of preparation activities and perceived self-efficacy for teaching civic-focused STEM-C curricula and pedagogy, integrating technology effectively and using data to improve instruction • Interviews with mentors, district partners, faculty, and project leadership on development of Pathway and program components • Reviews of program documents and technology portfolios • Data from surveys of Program Completers, Year One Teachers, and Employers of Year One Teachers (EdQ) • Program data on number of Residents who graduate, including demographic data to identify teachers from underrepresented groups • Student state assessment and pre-post benchmarks assessments data, analysis of student work
Goal 2: Sustain a pipeline of credentialed teachers who are committed to teaching civics-focused STEM-C curricula in high needs school districts by creating tailored recruitment, retention, and induction processes.	
<ol style="list-style-type: none"> 1) Conduct needs assessments of new TORs to design recruitment, retention, and induction services 2) Design tailored recruitment programs and processes to increase number of women and students of color in the Citizen Scientist Residency Pathway 3) Collaborate with state trained mentors 	<ul style="list-style-type: none"> • Program data on total number applied, number accepted, number enrolled, subject area of licensure, including demographic data to identify teachers from underrepresented groups and those with STEM and education-related backgrounds • Program and HR data on hiring, subject areas taught, and placement in high need areas and schools

<p>assigned to new TORs to develop annual Individualized Professional Development Plan to support retention</p> <p>4) Develop and implement Citizen Scientist Residency Pathway dimension to existing Induction Phase program of each LEA district</p> <p>5) Recruit, prepare, and support LEA district mentors and IHE faculty mentors to help Residents translate civics-focused STEM-C curricula, pedagogy, and assessment into their LEA classrooms</p> <p>6) Create instructional support team for each Citizen Scientist Resident</p>	<ul style="list-style-type: none"> • Retention data from program and district HR depts • Surveys and interviews with Residents on motivations for participating in the Project and teaching as a career, attitudes and beliefs about teaching STEM subjects • Surveys and interviews with graduates on quality of retention efforts • Surveys and interviews with mentors on their training and support to Residents • Interviews with principals, faculty, staff, and project leadership to understand development and implementation of recruitment and retention efforts • Reviews of program documents, including recruitment materials and Individualized Professional Development Plans
<p>Goal 3: Co-create and co-implement curriculum and multi-stakeholder structures for professional development that supports teacher leaders, site administrators, superintendents, and university faculty’s use of research-based best practices in the domains of teacher recruitment, retention, and induction, with an emphasis on STEM, civics, and computer science teaching and learning.</p>	
<p>1) Conduct needs assessments of Citizen Scientist Residency Pathway LEA and IHE stakeholders to determine scope and sequence of professional development.</p> <p>2) Design civics-focused STEM-C curricula, pedagogy, and assessment, including the Citizen Scientist Instructional Assessment Protocol</p> <p>3) Create professional development for teacher leaders, site administrators, university supervisors, and faculty on research-based practices for recruitment, retention, and induction, with emphasis on STEM-C fields; and intersections of civics, STEM, and computer science education</p>	<ul style="list-style-type: none"> • Surveys and interviews with professional development participants on the quality of the professional development and use of learnings • Interviews with project leadership on development and implementation of professional development • Reviews of program documents, including professional development schedules, materials, and attendance data • Review of district documents and policies for evidence of modifications to recruitment, retention, and induction practices

evaluation will collect valid and reliable performance data to report on relevant outcomes. The following section includes a detailed description of the evaluation sources and how they will inform the performance measures.

Project Implementation. In collaboration with the Citizen Scientist Residency Pathway, WestEd will collect formative data on project implementation, including the collaboration among partners, the development of new curriculum, resident recruitment, induction support, and professional development design and implementation. A clear understanding of the Citizen Scientist Residency Pathway will enable WestEd to suggest ways in which outcomes may be related to specific the project components, highlighting which components may be most critical, for whom, and under which conditions. Throughout the project period, WestEd will attend to the following: (1) grounding the evaluation in the Citizen Scientist Residency Pathway’s well-articulated logic model; (2) reviewing project documents and meeting often with leadership to ensure an up-to-date and complete picture of the relevant features of the Citizen Scientist Residency Pathway context; and (3) assessing the extent to which the project components are being implemented through surveys and interviews with relevant stakeholders, including mentors, residents, district partners, principals, faculty, staff, and project leadership, using protocols with open and closed-ended questions about how participants experience the program.

Continuous Improvement. The formative evaluation will include the use of built-in methods supporting continuous improvement to ensure that implementation efforts are informed by data that help project staff make midcourse corrections as needed. We will draw on an improvement science approach (Bryk, Gomez, Grunow, & LeMahieu, 2015), which WestEd has been supporting within many teacher preparation programs. The theory underpinning this approach is that substantial, sustained improvement is most likely to result from sustained

inquiry into the way a teacher preparation program produces its current outcomes and “testing” of changes that could lead to better outcomes. To establish and maintain effective feedback loops, WestEd will work with project staff to create a formal reporting cycle as well as ongoing informal collaboration and learning opportunities. All reporting of data and findings from the evaluation will be designed to help project staff use the information to reflect on current performance and assess high leverage opportunities on which to target ongoing improvement efforts.

The extent to which the methods of evaluation are thorough, feasible, and appropriate to the goals, objectives, and outcomes of the proposed project & The extent to which the goals, objectives and outcomes to be achieved by the proposed project are clearly specified and measurable.

The comprehensive evaluation approach is aligned to the three overarching goals of the Citizen Scientist Project and will utilize qualitative and quantitative data from a variety of sources to strengthen the validity of the results. For the duration of the study, WestEd will provide annual summaries of the quantitative teacher and student outcomes measures, including the GPRA and HEA performance measures. We will report progress on measures to ED and program stakeholders through Annual Performance Reports (APRs) and annual evaluation reports. The performance data, including GPRA and HEA measures, are organized and described below according to the three goals of Citizen Scientist Project.

Citizen Scientist Residency Pathway Goal 1: *Develop a pathway to increase the capacity of 240 multiple subject credential and 240 single subject credential Residents to design, facilitate, and assess high quality, civic-focused STEM-C pedagogy and curricula in high-needs schools.*

Evaluation questions related to implementation and impact include: How and to what extent is

the Citizen Scientist Residency Pathway: 1) effectively preparing participants to integrate civic-focused STEM-C curricula and pedagogy, and to use technology to collect and analyze data to improve teaching and learning outcomes; 2) creating a pathway to graduating and certifying multiple subject and single subject candidates; and 3) improving teacher effectiveness and achievement outcomes of students taught by Citizen Scientist Residency Pathway completers.

Teacher Preparation. Measures assessed related to teacher preparation include GPRA *Performance Measure 3: One-Year Persistence. The percentage of program participants who were enrolled in the postsecondary program in the previous grant reporting period, did not graduate, and persisted in the postsecondary program in the current grant reporting period,* HEA (i) *Percentage of teachers trained to integrate technology effectively into curricula and instruction, including technology consistent with the principles of universal design for learning,* and HEA (ii) *Percentage of teachers trained to use technology effectively to collect, manage, and analyze data to improve teaching and learning for the purpose of improving student academic achievement.* Project measures regarding teacher preparation will also assess candidates' specific subject matter preparation area; quality of preparation activities (i.e., the extent to which the Citizen Scientist Institute, clinical coaching cycles, and other preparation components contribute to Resident-perceived self-efficacy for teaching civic-focused STEM-C curricula and pedagogy, integrating technology effectively, and using data to improve instruction); and pedagogical methods employed using the Civics-Focused STEM-C Assessment Protocol. Data for the measures will be collected through the Citizen Scientist Residency Pathway archival program data, including data on CalTPA passage rates, a review of program documents, surveys and interviews with Citizen Scientist Residency Pathway Residents on the quality of the preparation activities and perceived self-efficacy, interviews with mentors, district partners,

faculty, and project leadership on the development of the Pathway and specific program components, and reviews of program documents and Resident technology portfolios.

Graduation and Certification. GPRA and HEA each require measures related to graduation and certification. WestEd will assess GPRA *Performance Measure 1: Certification/Licensure. The percentage of program graduates who have attained initial State certification/licensure by passing all necessary licensure/certification assessments within one year of program completion,* and *Performance Measure 2: STEM Graduation. The percentage of math/science program graduates that attain initial certification/licensure by passing all necessary licensure/certification assessments within one year of program completion* by obtaining data from the Citizen Scientist Residency Pathway on degrees and specific teaching certifications (including authorized subject matter and grade spans) obtained by Residents and dates awarded, to assess whether they were obtained within the measure-specified timeframe. To assess passing of initial and necessary certification/licensure assessments, we will obtain Residents' scores on the state licensure exams, the CSETs, as well as data from the CalTPA assessment tasks and the RICA, from the Citizen Scientist Residency Pathway documents (as the programs are responsible are for verifying passing of assessments). HEA also requires a measure *on achievement for all prospective and new teachers, as measured by the eligible partnership, and improvement in the pass rates and scaled scores for initial State certification or licensure of teachers.* To assess achievement for prospective and new teachers as well as the improvement in the pass rates, we will collect results from the CalTPA directly from the program.

growth of students taught by graduates, as well as select teacher outcomes resulting from participation in the Citizen Scientist Residency Pathway, using a QED. In the final year of the evaluation, pending appropriate comparison data, we will implement a QED to address whether the Citizen Scientist Residency Pathway model is more effective at preparing teachers than traditional teacher preparation program pathways. Waiting until the final year of the evaluation will allow us to pool data from all available appropriate cohorts to increase our sample size. The teacher outcome variables for the QED will be measures of teacher preparation drawn from the surveys of Program Completers, Year One Teachers, and Employers of Year One Teachers available from the EdQ Center and teacher performance as measured by the CalTPA; teacher placement in a high-needs school; and teacher retention. Student growth will be measured by an aggregate score based on a combination of end of year state assessments, pre-post common benchmarks assessments and an analysis of student work.

To facilitate acquisition of comparison teacher data for a QED we will develop a data sharing MOU with the EdQ Center. Beginning in 2014, EdQ began developing an integrated warehouse system that consolidates several existing but previously unconnected data collection efforts across all 23 CSU campuses. This effort will result in a longitudinal data system that compiles measures of professional educator practice and placement and retention outcomes in a centralized system. The EdQ data warehouse and dashboard system currently includes data collected through three annual surveys as follows: Program Completers (perceptions of preparation, confidence in career placement and success at the end of the candidate year); Year One Teachers (placement, experience, and perceptions of preparedness for teaching at the end of the first year in teaching); and Employers of Year One Teachers (perceptions of the skills and abilities of CSU completers relative to current needs). Beginning in the 2018-19 academic year,

EdQ data will also include candidate demographic and “pipeline” data. These data will include: CSU program applicant data (e.g., undergraduate institution and GPA, demographic information), CSU program completer and credential data, post-completion placement data, and retention in teaching data.

Citizen Scientist Residency Pathway Goal 2: *Sustain a pipeline of credentialed teachers who are committed to teaching civics-focused STEM-C curricula in high needs school districts by creating tailored recruitment, retention, and induction processes.* Evaluation questions related to implementation and impact include: How and to what extent is the Citizen Scientist Residency Pathway: 1) encouraging diverse candidates to apply to the program and selecting high-quality candidates for participation; 2) placing teachers in high-need subject areas (including special education, language instruction, and educational programs for limited English proficient students); and 3) supporting and retaining teachers in high-need districts.

Recruitment and Selection. To assess the effectiveness of the Citizen Scientist Residency Pathway recruitment campaign and track progress on recruitment and selection, we will assess project measures on recruitment targets; selection rates; candidates from underrepresented groups; candidates with STEM and education-related backgrounds (based on prior employment, career path, major, and granting institutions); GPA; and Learning Mathematics for Teaching or NGSS practice test, CBEST, and CSET passing rates. These data will be collected from program data on the total number who applied, number accepted, number enrolled, subject area of licensure, and demographic data. We will also use surveys and interviews with Residents to assess their motivations for participating in the Citizen Scientist Residency Pathway and teaching as a career, and attitudes and beliefs about teaching STEM subjects; interviews with principals,

faculty, staff, and project leadership to understand development and implementation of recruitment efforts; and reviews of program documents, including recruitment materials.

Placement. As noted above, the HEA requires a measure on *achievement for all prospective and new teachers, as measured by the eligible partnership*. For new teachers WestEd will compile data by district human resources (HR) departments on number of completers hired by the LEAs, a process which will be formalized with data sharing MOUs between WestEd and the Citizen Scientist Residency Pathway and each participating district: Bakersfield City School District, Greenfield Union School District, and Kern High School District. The HEA also requires measures regarding hiring, subject areas taught, and placement in high need areas and schools. Specifically we will assess the percentage of highly qualified teachers: (1) *hired by the high-need LEAs participating in the eligible partnership* (85% target); (2) *who are members of underrepresented groups* (e.g., African-American, Hispanic/Latino, or Native Hawaiian or other Pacific Islander; target increase of 20%); (3) *who teach high-need academic subject areas* including reading, mathematics, science, and foreign language, including less commonly taught languages and critical foreign languages (85% target); (4) *who teach in high-need areas*, including special education, language instruction educational programs for limited English proficient students, and early childhood education (20% target); and (5) *who teach in high-need schools* (85% target), *disaggregated by the elementary school* (85% target) *and secondary school levels* (85% target) in the partner districts. All data on hiring, subject areas taught, and placement in high need areas and schools will be collected annually from the program and surveys of its completers and will be verified with data from district HR departments.

Retention. We will assess measures of retention, specifically, *teacher retention in the first three years of a teacher's career* (85% target), an HEA measure, and two GPRA measures:

Performance Measure 4: One-Year Employment Retention. The percentage of program completers who were employed for the first time as teachers of record in the preceding year by the partner high-need LEA program and were retained for the current school year, and

*Performance Measure 5: Three-Year Employment Retention. The percentage of program completers who were employed by the partner high-need LEA program for three consecutive years after initial employment. We will calculate annual retention rates using the initial number of completers per cohort, as opposed to the number of teachers remaining in the cohort in the prior year. Annually we will collect data directly from partner districts' HR departments on Citizen Scientist Residency Pathway completers' teaching placements to determine the teachers retained in teaching from each cohort. We will gather information on which teachers resigned a teaching position or obtained a non-teaching position and what new position within or outside the district the former teacher assumed. Analyzing these data will yield findings for all retention measures. We will also use surveys and interviews with graduates to assess the quality of the retention supports; surveys and interviews with mentors on their training and supports they provide to Residents; interviews with principals, faculty, staff, and project leadership and reviews of program documents, including Individualized Professional Development Plans, to understand development and implementation of retention efforts. We will determine the *GPRA Efficiency Measure: The Federal cost per program completer (in the final year of the project period)*, by assessing grant expense budget reports to calculate the grant funds spent divided by the number of program completers.*

Citizen Scientist Residency Pathway Goal 3: *Co-create and co-implement curriculum and multi-stakeholder structures for professional development that supports teacher leaders, site administrators, superintendents, and university faculty's use of research-based best practices in*

the domains of teacher recruitment, retention, and induction, as well as the intersections of STEM, civics, and computer science education. Evaluation questions related to implementation and impact include: How and to what extent is the Citizen Scientist Residency Pathway: 1) engaging education leaders to implement research-based best practices in regard to teacher recruitment, retention, and induction; and 2) improving the knowledge of education leaders about the intersections of civics, STEM, and computer science education.

Professional Development. To assess the efforts of the Citizen Scientist Residency Pathway in informing and engaging education leaders in the work, we will collect data on participation in professional development offerings, understanding and use of data for improvements to their recruitment, retention, and induction processes, and understanding of the intersections of civics, STEM, and computer science education. The data will be collected through reviews of program documents, including professional development schedules, materials and attendance data; surveys and interviews with professional development participants on the quality of the professional development and use of learnings; interviews with project leadership on development and implementation of professional development; and reviews of district documents and policies for evidence of modifications to recruitment, retention, and induction practices.