2019 CAP RESEARCH EXPERIENCE FOR TEACHERS PROGRAM

PROGRAM DESCRIPTION & JUSTIFICATION

Teachers are our facilitators of scientific research to the nation's youth; they require training and continuing education in order to bring innovative research into the classroom. With our exponentially expanding publications of scientific research, teachers are finding that incorporating innovative scientific research and data into the classroom is an ever-daunting task. The Central Arizona-Phoenix Long-Term Ecological Research Program (CAP LTER, or CAP) has been producing cutting edge knowledge about urban systems science for more than 20 years, and our Ecology Explorers Program has been putting CAP knowledge into the hands of Phoenix area teachers throughout this time. CAP also provides local K-12 educators with access to nearly 60 research faculty and dozens of students and postdoctoral fellows representing a diverse array of disciplines and fields of expertise. As a supplement to our ongoing Ecology Explorers Schoolyard LTER work, we propose to pair two outstanding Roosevelt Public School District teachers with researchers from relevant Interdisciplinary Research Teams (IRTs) to improve the science expertise of our Phoenix area teachers. By doing so, we will continue to build collaborative relationships among K-12 science educators, the CAP LTER, and the NSF research community. The two teachers have already been selected (Caroline Carlson and Monique Franco, biographical sketches included) and below we detail the criteria we used to select them.

Our choice to focus this RET Program on the Roosevelt School District in the City of Phoenix is deliberate, for several reasons: a) the District serves a lower income, predominantly Hispanic population (97% of the students are minority); b) it includes one of our Phoenix Area Social Survey (PASS) neighborhoods (#U18), where 93% of residents are Mexican/Latino, where the median annual household income is less than $37,000 and where less than 4% of residents hold a bachelor's degree or above (Larson et al. 2017); c) it is part of the City's South Mountain Village (which is 63% Hispanic and 15% Black), where our scenarios and futures work is currently taking place; d) it is near the Rio Salado and South Mountain parks, where our Parks & Rivers IRT is working and; e) our Ecology Explorers Program has been working with teachers from the District for many years, and we already have teacher and administrator connections, collaborations, and a history of success.

Implementation of the RET Program:

Both teachers will be exposed to a variety of research experiences in the CAP Program, and will be able to choose the specific research collaboration that fits best with their interests and pedagogical needs. The RET Program will be conducted primarily during the summer months but will continue through the school year to ensure a smooth transition of information from the RET to the classroom. There will be four components to RET involvement with CAP:

1. Both teachers will be briefed about the research program and the nature of their training experience, and will be asked to choose an IRT for their research experience. Of our eight IRTs, the four that are most logical for RET collaborations are Residential Landscapes & Neighborhoods, Scenarios & Futures, Parks & Rivers, and Adapting to City Life; we have identified potential faculty and student mentors for RET participants in all four IRTs. For example, if a teacher is interested in how people interact with their immediate residential environments, they might choose to work with the Residential Landscapes & Neighborhoods

IRT. If they are interested in nearby recreational spaces or urban flora and fauna, they might choose to work with the Parks & Rivers IRT or Adapting to City Life IRT. And if they are interested in knowing more about a sustainable future for South Mountain Village, they might choose to work with the Scenarios & Futures IRT.

2. Each teacher will be required to spend six summer weeks conducting field and lab work with mentors from the IRT of their choosing, working on an independent research project that best fits their interests and classroom needs. These projects may involve the use of existing long-term data, collecting new data, or a combination of the two.
3. After the summer research has been completed, we will host a half-day mini-workshop where the RET participants will informally present their research findings, discuss their summer experiences, receive input from other members of their IRTs, and finalize their plan for translating their experiences into their 6-8th grade classrooms and their K-8 school district. This mini-workshop will also help prepare the teachers to present their research and classroom experiences at a statewide or national science educator conference during the school year.
4. During the 2019-20 school year the teachers will bring their hands-on research experiences into the classroom for their students. The teachers will develop classroom activities that incorporate their CAP data. They will be able to continue their collaborative research experiences with their IRT mentors and other CAP researchers throughout the school year.

Translating RET experiences into classroom practice:

Caroline Carlson and Monique Franco have both committed to several activities that will allow them to translate their research experience to Phoenix area students:

1. Self-development as science educators through their direct work as researchers alongside professional research scientists.
2. Integration of their new research knowledge and skills into classroom curricular materials. This includes modeling of scientific research protocols and practices, incorporating the relevance of our local urban and Sonoran Desert ecosystems into required curricular concepts, and encouraging career exploration into scientific fields.
3. Development of a 'cross-walk' tool that aligns our dozens of CAP LTER Ecology Explorers lessons with district objectives for Science, Mathematics, and ELA/English Language learning, to be utilized district-wide.
4. Lead a district-wide workshop for K-8 teachers, introducing them to Ecology Explorers resources, the fundamentals of scientific research, and the cross-walk tool they developed.
5. Present on their research and classroom experiences at the Arizona Science Teachers Association Conference, in October 2019, introducing Association members to Ecology Explorers resources and demonstrating how research-classroom integration worked in the Roosevelt School District.
6. Present on their research and classroom experiences at the National Science Teachers Association STEM Leadership Alliance Summit, in July 2020, describing their experiences with research, integration into their classrooms and across the district, and demonstrating the breadth of positive outcomes for teachers empowered to work with research scientists and institutions of higher learning.

Selection criteria for RET participants:

The CAP LTER Ecology Explorers program has worked with hundreds of teachers for over 20 years. Over those years, select teachers have demonstrated initiative and eagerness to continue

working with the program, and we often rely on this pool of teachers to pilot new lessons, approaches, and experiences. For this RET opportunity, we only solicited applications from Roosevelt School District teachers, ensuring maximal RET impact on schools serving largely minority students. As we've worked with over a dozen teachers from this district, we whittled down the list to those who are most familiar with our CAP IV conceptual framework and approaches. We received guidance on teacher selection from the Roosevelt School District's Science and Sustainability Specialist, Cassandra Kellaris, with whom Ecology Explorers has worked closely on past projects. We then sought out those who were interested in participating as a partner-team from the same school. In our experience, this partnered approach produces superior outcomes for the teachers, through collegial support, while also compounding impacts when the two teachers return to their school and districts for implementation as a unified team. We solicited biographical sketches (included here), and a short essay describing how this RET opportunity would impact their students, teaching, school, and district.

Research mentor experience and selection:

CAP has not received an education supplement in many years, but our Ecology Explorers Schoolyard LTER Program has always focused its impact and excellence on K-12 teachers. Because of this extensive experience in working with secondary school educators, including those from the Roosevelt School District, we are confident in our ability to select and manage the best research mentors for our RET participants. Many CAP faculty, postdocs, and students have worked closely with our Ecology Explorers program through other NSF-funded education programs, including a 10-year IGERT focused on urban ecology, a more recently funded GK12 grant, and our currently funded Urban Resilience to Extremes Sustainability Research Network (SRN).

LITERATURE CITED

Larson, K.L., R. Andrade, and A. York, 2017. The Phoenix Area Social Survey IV: Linking social and biophysical dynamics in urban neighborhoods. Program Report, pp.44.

RET BUDGET

Budget Item	Requested Costs
1. Teacher stipends (2) as Participant Support	14000
2. Conference travel as Participant Support	2000
3. Field and lab supplies as Direct Costs	1900
5. Indirect costs (54.5% of Direct Costs)	1036
4. Total requested costs	18936

RET BUDGET JUSTIFICATION

Summer stipends are requested for both teachers ($7000). Input from teachers participating in our Ecology Explorers program often includes a desire to be able to attend regional or national K-12 education conferences or workshops, and this travel is rarely supported by their principals or school districts. We thus request $1000 each to all our RET participants to attend a conference or workshop of their choice. Both stipends and travel are budgeted as participant support costs. Funds for field and lab supplies ($950 each) will carry ASU's full indirect cost of 54.5%.

Biographical Sketch: Caroline Carlson

My name is Caroline Estrada Carlson. I am a first generation Mexican-American, and the first in my family to graduate from a four-year university. Growing up, education was difficult for me because both my parents were working parents, and my grandmother, who raised me, only spoke Spanish. I had to study diligently to complete my college-bound high school courses. In 2016, I graduated from Mary Lou Fulton Teachers College, Arizona State University with honors. I decided to become a science teacher in a Title 1 school, similar to the one I attended as an adolescent. My goal as an educator is to break down the gender and minority gap in science career fields. Throughout my 4 years in the education field my biggest accomplishments include the ASTA Novice Science Teacher of the Year and AmeriCorps National Service Award. I continue to push myself by leading STEM clubs, participating in professional developments, and serving in leadership roles at both the school and district level.

I strive to promote STEM equity outside of my classroom. In the last three years, I developed and led a STEM Club and Robotics Club on campus. Using Chromebooks won with a grant, I taught students to code, and then to use coding to run student-built Vex and Finch robots. The students presented their completed projects at the annual STEAM Festival at South Mountain Community College in front of hundreds of attendees from both the public and industry. At this festival, my students taught other students how to have their robots overcome an obstacle course using scratch programming by M.I.T. Currently, I lead the Chief Science Officers (CSO) program. CSO teaches students to advocate as STEM leaders in their community by creating and attending STEM related events, and networking with other CSOs and STEM businesses, such as Honeywell. One of our biggest initiatives this year is running our junior high science club and participating in the Honeywell Aerospace Challenge. For this challenge, our science club is competing in teams to research, design and build a model for a space mission to colonize the Martian moon Phobos.

In addition to the clubs, I am also our junior high's team lead, Head of the Science Department, and head of the High School Readiness Board at our school. As the High School Readiness Lead I have planned field trips to the ASU School of Earth and Space Exploration and Northern Arizona University. I also hosted three different STEM related high school magnates to speak with my students. I have seen immediate results from my efforts as multiple students have chosen to attend Bioscience High School, Phoenix Coding Academy, and the IB program at North High School, all of whom are the first from our school to attend.

Moreover, I am continuing to expand on my professional growth as an educator. In the past year, I attended various professional developments regarding innovative programs and topics such as problem-based learning for English Language Learners (PBELL) by Arizona State University, science note booking by National Geographic, engagement through online simulations by Explore Learning, and connection to field trip opportunities related to the curriculum by Arizona State School of Earth and Space Exploration. Formally, I was selected by former professors at ASU to speak to Mary Lou Fulton Teacher's College students on the topic of inclusion of STEM vocabulary to English Language Learners. On a weekly basis, I lead the professional learning community meetings with my junior high team to implement best practices on our teaching and identify interventions for individual students. Currently, Roosevelt School District selected me to be a science lead on the district assessment team. Through this team, I work collaboratively with other science teachers in the district to create and revise assessment questions for each essential science standard kindergarten through eighth grade. The assessments will be used by the nineteen schools in our district to assess their students' progress. Creating assessments has given me a deeper

understanding of the standards, and has allowed me to network with other teachers in our district to help improve our instruction. Overall, these positions have allowed me to influence students through new practices and opening opportunities to STEM for my students.

Biographical Sketch: Monique Franco

My name is Monique Franco and I'm a 6th grade teacher at Irene Lopez School in the Roosevelt School District. As an elementary student myself, school did not matter to me. Where I would sleep, what I would eat, or whether or not we would have electricity or hot water was more important than numbers and letters. How well I did on my homework or test didn't change how hard my parents fist-fought or how cold the water ran, if it ran at all. It wasn't until 7th grade ELA with Mrs. Shoemaker that things changed; I had never felt seen until I had her as a teacher. Through the use of journaling and time, I now know she probably didn't have, she helped me see that education was exactly the focus I needed and it gave me purpose in life. I understood how important it was to be a learner.

Not only was graduating high school an accomplishment in a family of cyclical drug and alcohol abuse, but I was able to do so as the Student Body President and Valedictorian. Furthermore, I was accepted into Barrett, the Honors College at Arizona State University where I was able to work with faculty members on honors projects. For example, I completed an analysis of children's literary structure then applied various techniques to create my own picturebook, *Afrodite*, which was then used in partnership my professor to present at the Arizona English Teachers Association conference. During my senior year, I was selected to be a Rodel Promising Teacher and was awarded the Segal AmeriCorps Education Award for my contribution to public service through my classroom internships. Additionally, a colleague and I completed a thesis on the Bilingual Education and English as a Second Language program at Arizona State University in which we examined the effectiveness of the program to prepare teacher candidates in culturally and linguistically diverse classrooms. Our findings were then presented at an honors symposium and at the Center for Educational Resources in Culture, Language and Literacy conference. I graduated from Barrett summa cum laude and joined a community of high school-ready and college and career-bound learners, leaders and achievers at Irene Lopez in the Roosevelt School District as a 6th grade Math teacher.

Since the start of my employment, my career at Irene Lopez has been a fulfilling experience. I have coached the girls volleyball team for the last 3 years. Rather than focusing on winning and the sport itself, we looked at effort, positivity, and respect. Throughout the last 2 years of being Student Council supervisor, we've raised thousands of dollars that have been used to support school initiatives and sponsor student and community events. Partnering with community members such as The Roosevelt Center of Sustainability, Maricopa County Cooperative Extension, and the University of Arizona, the Lopez Garden Club was established at our school. We started last year with field trips to The Roosevelt Center of Sustainability in which the students learned about topics such as types of energy, pollinators, and the water cycle and have since started our own garden beds on campus where the students continue to learn about different aspects of gardening. From sports to gardens, no matter the interests of the students, community and learning through experience is always at the core.

In addition to extracurricular activities for the students, I continue my growth with professional development and leadership opportunities in and outside of the district. At Irene Lopez, I served on our school's Mission Cabinet which met monthly with our administrators to assist with the planning and organization of staff development and school initiatives. This allowed me to establish a professional relationship with the leaders on campus while exploring possibilities in administrative work in the future. The district assessment team, a group of selected teachers that I worked with in 2017-2018, created standards-based assessment items for use throughout the district.

Collaborating with fellow educators created connections and a better understanding of content while identifying areas of improvement. With changes constantly happening with curriculum, it has always been important to be a learner. With allotted time for Science incorporated into the bell schedule, as opposed to ELA integration, I attended professional developments lead by the district's science specialist to better understand best practices for science instruction. Training for online resources such as how to use the Pearson text and its features or how to use Explore Learning interactive science and math simulations that promote inquiry allowed me to better teach a new subject. At the District Science PLC event in which the topic of scientific communication was discussed, teachers were able to visit stations with examples of scientific discourse in the class and had an opportunity to plan implementation in their own classrooms. Similarly, on a grander scale, Arizona State University's STEM camp, brought together novice and veteran science teachers together in a week-long event that featured problem-based learning workshops aimed to support language learners. The provided resources and strategies are tools that I will continue to use and learn from regardless of the demographics, content, or grade.

The empowerment of people through experience and education when communities work together is the only way we will combat the imbalance of educational equity for all. I am aware of my inexperience as a new science teacher but I am confident in my experience as a learner. My hope in working with community members is I will continue to build my repertoire of knowledge to better motivate and support our children.