Science Communities of Practice Partnership (SCOPP) response to the pandemic

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Example shifts in research questions[1]

Line of inquiry	Original research questions (we will still be researching these)	Pandemic pivot research questions
Effect of PD treatment	1a. In what ways does participation in Intensive PD and communities of practice differentially affect (ii) *Shifts in organizational conditions* over time?, and (iii) *Improvements in science teaching* over time? 1b. How do *SCOPP treatment* teachers' ownership and teaching improvement compare to teachers in the *Intensive PD only* and *comparison* groups? 1c. What aspects of the PD model most prominently affect organizational conditions, and subsequently, improvement in science teaching?	1a. How does participation or in full or partial treatment professional development during a time of crisis encourage innovation in science teaching, including: • increased attention to equity? • use of distance learning to facilitate student sense-making? 1b. How are teachers in the different conditions taking up pedagogical practices of equity, three-dimensionality, and discourse in their distance instruction, and what does it afford for student sensemaking?

Pandemic challenges and response professional development

The Covid 19 pandemic began towards the end of our second year of professional development. Our collaborative partnership met with teachers several times at the start of the pandemic to understand their needs in terms of science education. To meet these needs, we shifted the Saturday workshop in May and the summer institute to an online format, which generally continued to focus on SCOPP outcomes. The PD team has also created a range of informational, instructional, and digital learning tools that teachers could use to support students. We began holding consultancy hours and tech support once per week. Many teachers were starting to use Zoom, Google Classroom, SeeSaw and other platforms to meet with their students in real time, and the PD team was on hand to help teachers gain new knowledge and skills to connect with students. Additionally, the PD team helped teachers learn about interactive digital tools designed to support student engagement and discourse through distance learning, such as Flipgrid for short videos, Padlet as a hub for dialogue and sharing ideas, and interactive slides to organize science lessons and activities for students.

The pandemic PD was deliberately designed to support teachers in increasing their familiarity and comfort level with these and other digital tools for use in their classrooms and

[1] Please note that some areas of this documentation have been slightly modified to protect participants and the overall research.

their science instruction. Our approach generated considerable interest among teachers, garnering a summer institute enrollment of 76 teachers.

In order to meet teacher needs, we split the summer institute in half with shorter days because of the zoom format. The first week, science faculty led sessions focused on science content with integrated pedagogy. The second week focused on pedagogy with the following topical areas:

- Differentiated strands to deepen teachers' knowledge on three-dimensional and phenomenon-based teaching
- Building community in distance learning with a focus on equity
- Crosscutting Concepts
- Developing a distance learning 5-E Lesson plan

In addition, for full treatment teachers we facilitated a book group over the summer focused on generating student explanations, "What's Your Evidence? Engaging K-5 students in Constructing Explanations in Science."

Moving forward, we will be conducting our professional development, including all elements noted above, in a distance format until public officials allow for in-person meetings. This will likely be throughout much of 2020 – 2021. The PD team is working hard to reimagine the Lesson Study experience for teachers with online planning meetings and opportunities for teachers to individually record and share their own classroom science lessons with their team. Our facilitators continue to grow their proficiency at presenting online professional development, and teachers have expressed gratitude for their learning. For example, after Summer Institute one teacher wrote in a survey, "Thank you so much for introducing paddlet and nearpod. They seem SO awesome and I can't wait to try it out myself." On the final day of summer Institute, teachers expressed their gratitude. This is a segment of the chat from the last 20 minutes of the professional development:

- N: This is the best PD I have had.... in many years! Thank you so much.
- M: Thank to all our supportive staff!!!
- C: Wonderful work guys
- K: Hanging in there - I always love this PD. It just makes you feel appreciated as a teacher - they always listen to feedback. They give us such great lessons too!
- T: Thank you so much staff! Everytime I am involved in this PD. I learn so much and my students enjoy the activities and learn a lot.
- L Thank you. This is such a warm, supportive group to work with. I have learned so much from all of the leaders and my team mates. :)

Pandemic challenges and response research

We were able to collect the following second year (2019-2020) data with little compromise to the research design:

- Cohort 1 and cohort 2 post-survey data describing instructional practices pre-pandemic
- Cohort 3 pre-survey data describing instructional practices pre-pandemic
- Almost all necessary interviews across four sampled districts

- Recordings of in person professional development and lesson study through mid-march. Only one sample lesson study group was unable to complete their observation due to the pandemic. These recordings include data necessary for research regarding the student work analysis tool.
- 335 student surveys regarding teacher instructional practice
- 81 percent and 76 percent pre-and post-teacher assessments for summer 2019 quarterly PD respectively

The pandemic made the following data collection problematic to some extent. We describe how we resolved issues here.

- We were able to collect in-person videos of teacher instructional practice with a follow-up interview for 22 teachers. However, most of these videos were a pre for teachers in cohort two. We were able to collect 6 post videos for teachers in cohort one. Because the interview is a big part of this particular data set, we asked teachers who were unable to provide video data to participate in an interview over zoom. 10 additional teachers participated in an interview. We thus have interview data for 32 teachers and video data for 22 teachers.
- Science time check-in: We created a very short survey regarding minutes of science instruction and instructional strategies to send to teachers once per month. We were able to collect data using this instrument September through February. Starting in March, teachers were conducting distance-learning and we did not send them the questionnaire.

We anticipate that aspects of data collection will continue as planned, and others will need to be shifted due to the pandemic. Continue as planned:

- Interviews will continue as planned over zoom. Interview questions will shift slightly to encompass science education during the pandemic.
- Recordings of professional development will continue over zoom.
- Tool development interviews and meeting recordings will continue over zoom.
- Teacher content assessment will continue to be collected online.
- We slightly modified the science time check-in to include synchronous and asynchronous lessons. This will be given for teachers once per month as indicated in the research design.

There are a couple of aspects of data collection and research design that will need to be shifted to account for the pandemic. The biggest issue pertains to collecting data regarding one of our main outcomes, classroom practice. In California, instruction went online mid-March 2020, and continued through the end of the school year. All of our partner districts plan to begin the 2020 – 2021 school year in an online format. There is no guarantee that in person schooling will happen anytime soon. If it does, it is unlikely school districts will allow outsiders into classrooms to collect data. This situation impacts both our video data collection and instructional practice survey. We are currently working on a plan to observe teacher instructional practice via zoom (if distance-learning) or have teachers video their own classrooms (if in person). If instruction is via distance-learning all school year, we will consider revising the instructional practices survey

and student survey to reflect distance-learning science education. However, this brings up additional issues in that the pre-and post-survey would not be comparable.

SCOPP Project Summary

Overview. The **Science Communities of Practice Partnership (SCOPP): Generating Ownership for Transforming Science Teaching** is an **Implementation and Improvement project** that addresses the **Teaching Strand.** The SCOPP project presents a rare opportunity to ***develop and study an effective professional learning model that translates content and pedagogy that are learned in PD into sustainable improvements in science teaching.*** SCOPP builds on an 8-year science professional development (PD) program and research partnership between California State University East Bay and the Alameda County Office of Education. Grounded in the literature and our prior NSF work, SCOPP is based on the following three principles: **1) Content and pedagogy PD alone are inadequate** for effective and sustainable instructional reform. Sustainable improvement in science teaching requires teacher and administrator **ownership**, especially at the elementary level. **2) Supportive organizational conditions** are also necessary for sustainable shifts in instructional practice. **3) Reciprocal Communities of Practice (RCoPs)** are critical for fostering ownership and building supportive organizational conditions. SCOPP will implement and study an innovative professional learning model, consisting of intensive PD (content and pedagogy) coupled with participation in three RCoPs, in which teachers, administrators, coaches, and faculty interact: District Leadership Collaboratives, Lesson Study, and Instructional Innovators. SCOPP focuses on 3rd to 5th grade teachers in four urban school districts, supporting NGSS-based science teaching in these diverse settings, and conducting an implementation and improvement study that capitalizes on, and attends to, variation across educational contexts.

Intellectual Merit. Very little is known about professional learning approaches that successfully sustain high quality elementary science education (Dorph, et al., 2011). SCOPP will contribute to research and practice in the following ways: **First**, the project will provide evidence regarding specific components of an innovative PD model that supports sustainable improvement in science teaching among both participating teachers and their grade level colleagues. **Second**, the project will develop and test the theory of ownership and organizational conditions as mediators of instructional change, advancing knowledge of processes underlying sustainable improvements in science teaching for individuals and organizations. **Third**, the project will test, refine, and disseminate 4 tools to facilitate teacher learning and organizational capacity building. The research design consists of a mixed-methods, longitudinal quasi-experimental design that will contrast the effects of teacher participation in the full SCOPP model (Intensive PD + RCoPs; treatment 1) vs. an Intensive PD only (treatment 2), vs. a comparison group. Latent growth curve modeling and longitudinal latent mediation models will be used to examine shifts in science teaching over 3 years, as well as the mediating roles of reform ownership and organizational conditions between PD and improvements in science teaching. Qualitative methods will be used to explicate the processes within the SCOPP professional learning model that facilitate the intended outcomes. Finally, the design incorporates testing and refining 4 tools that support practical shifts in science instruction and organizational practice.

Broader Impacts. SCOPP supports elementary teachers and administrators in increasing underrepresented students' access to NGSS-based learning. **Locally**: SCOPP will 1) provide pivotal professional learning opportunities to 72 teachers and 32 administrators who serve 6500 diverse students across four districts; with the potential for spread to 144 additional teachers; 2) Foster sustainable, supportive organizational conditions in partner districts; and 3) Strengthen collaboration between CSUEB and regional STEM education partners. **Statewide:** Co-PIs' leadership roles on state and national NGSS leadership supports the direct dissemination of results and tools amongst science curriculum leaders--informing new standards roll-out across California and the United States. **Nationally**: SCOPP tools and professional learning model serve a crucial national need, as science educators are clamoring for tools to guide the instructional and organizational changes needed for high-quality science education. Tools and results will be disseminated nationally through presentations, policy briefs, and existing websites.