Supporting Urban Science Teachers in Making Instructional Decisions to Facilitate Project-Based Learning for All Students

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Project Summary
- This work is part of a larger study tasked with developing and testing an interdisciplinary curriculum to support high school students in developing integrated understanding of disciplinary core ideas, scientific practices and crosscutting concepts related to forces and interactions that occur between atoms and molecules to explain phenomena.
- Our study focuses on two teachers working in different schools in the Los Angeles Unified School District.
- Each teacher also participated in a year long professional learning program with two additional LAUSD teachers that included a summer training institute, a collaborative, virtual professional learning and two additional LAUSD teachers that included a year long professional learning program including content focus, active learning, coherence, sustained, and cooperative participation.
- Our year long professional learning program included intensive support during the first semester, and moderate support during the second semester (Figure 2).
- Professional learning activities included:
  - Summer training institute: Focus on content, 3D instruction and the Interactions curriculum.
  - Weekly, virtual PLC: Five teachers met weekly and alternated between two activities: each teacher actively participated by presenting student work, and through a weekly book study using NGSS for All Students (Figure 3).
  - Weekend workshops: Weekend workshops revisited content from the summer institute, and drew upon PLC conversations.
  - Instructional coaching: Each teacher participated in individual instructional coaching sessions after classroom observations during the semester with intensive support.

Research Question
- How can implementation of an educative, project-based, three-dimensional science curriculum paired with a sustained, blended professional learning program impact teacher's instructional decisions and support student learning?

Blended Professional Learning Program
We grounded the professional learning program in research on effective teacher professional development. Considerable evidence identifies five features of effective professional learning programs including: content focus, active learning, coherence, sustained, and cooperative participation.

Data Collection and Analysis
- Data collection:
  - During Intensive support, data included video recorded professional learning sessions, video recorded classroom observations, audio recorded interviews, and audio recorded instructional coaching sessions. The instructional coach also recorded field notes during observations.
  - Data collected was organized into “teaching episodes” which included a pre and post observation interview, and 250 minutes of continuous instruction.
- Data Analysis (Curriculum): We first conducted an analysis of the Interactions curriculum using section 1 of the EQP rubric to determine whether the curriculum was truly aligned to all three dimensions, and supported coherence within and between units.
- We also evaluated the curriculum for instructional supports that may promote equity using the Framework for Inclusive, Three-dimensional Science Classrooms.
- Data Analysis (Instruction and Professional Learning):
  - Classroom video was analyzed using the Framework for Inclusive, Three-dimensional Science Classrooms and for features of Project-Based Learning.
  - Summaries were developed for each lesson where these instructional techniques were integrated.
  - Audio-recorded interviews and professional learning sessions were analyzed for changes in how teachers talked about their instruction, and for evidence of integrating project-based learning with inclusive science instruction.
- We also evaluated the curriculum for instructional supports that may promote equity using the Framework for Inclusive, Three-dimensional Science Classrooms.

Evidence-Based Results
Nathan:
- Nathan’s goal in improving instruction was to elicit knowledge from students and support them in generating thoughtful questions, and 2) engaging students in scientific practices.
- In developing his own digital, anonymous Driving Question Board, Nathan was able to elicit ideas and questions from students by giving them voice in an online space.
- To elicit further ideas and experiences from students, Nathan prompted students to “Think of one piece of evidence that you have from your life that you have observed to support that claim”.

Mark:
- Mark goal in improving his instruction was to center students in discussions by becoming a strong facilitator.
- In this lesson, Mark engaged students in two aspects of project based learning: 1) engaging students in scientific practices, and 2) facilitate collaborative activities.
- By asking students to review the work of peers and generating project based learning: 1) engaging students in scientific practices, and 2) facilitate collaborative activities.

Implications and Impact
- We know that both curricular materials and professional learning opportunities can influence the instructional decisions that teachers make. Aligning goals of professional learning programs with research-based curriculum can support teachers in making instructional decisions that support their individual student’s science learning needs.
- Scale-Up: In 2017, Nineteen additional teachers from LAUSD and twenty teachers across Michigan participated in our professional learning support during Interactions implementation. Currently, our curriculum and professional learning support is being implemented with two hundred and fifty K-12 teachers in the Detroit Public Schools Community District.

Data Analysis (Instruction and Professional Learning)
- Five teachers met weekly and alternated between two activities: each teacher actively participated by presenting student work, and through a weekly book study using NGSS for All Students (Figure 3). Discussions in the PLC focused on promoting equity.
- Weekend workshops: Weekend workshops revisited content from the summer institute, and drew upon PLC conversations.
- Instructional coaching: Each teacher participated in individual instructional coaching sessions after classroom observations during the semester with intensive support.

Interactions Curriculum
- Designed to support high school physics classroom in a public school with predominately Latinx students.
- Our study focuses on two teachers working in different schools in the Los Angeles Unified school district.
- Each teacher also participated in a year long professional learning program with two additional LAUSD teachers that included a summer training institute, a collaborative, virtual professional learning community, 3-weekend workshops and in-person instructional coaching sessions.

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Evidence-Based Results
- Nathan’s Instructional Goal: “That’s where I think I’ve been disappointed in the past is trying to get students to ask questions. They are not used to having to express ideas in words. I have to keep pushing to try to get more out of them, and it’s kind of a new experience for them."

Mark:
- Mark’s Instructional Goal: “I want to show the class I am a strong facilitator, they can depend on. In my traditional teaching, when it was silent it meant... I needed to fill it. But now if I am supposed to build off their knowledge and I don’t have a question already prepared, I feel like a fool.”

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Research Question
- Our study features the development of a multi-phase, blended professional learning program to support teachers in integrating equitable teaching practices with three-dimensional instruction. To address our research question, we follow two teachers who participated in our program while implementing the project-based, three-dimensional curriculum, Interactions.

Mark goal in improving his instruction was to center students in discussions by becoming a strong facilitator. In this lesson, Mark engaged students in two aspects of project based learning: 1) engaging students in scientific practices, and 2) facilitate collaborative activities. By asking students to review the work of peers and presenting student work, and through using the Mystery box lesson facilitated understanding of evidence-based explanations and positioned students as generators of knowledge by allowing them to determine “What is evidence?”

Figure 5: Nathan – Demonstration

Figure 6: “What is evidence?” The Sizing Activity

Figure 7: Mark – Class discussion

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