Boosting Data Science Teaching and Learning in STEM

About the Project

The goal of this project is to develop and test a professional learning experience that improves teachers' and students' data fluency in math and science in grades 6–9.

What is Data Fluency?

We define data fluency as the ability and confidence to actively make sense of and use data. Data fluency extends beyond possessing discrete knowledge and skills to knowing when, how, and why to use data to explore topics of interest and for a specific purpose. Learners develop this fluency by exploring data, getting data, asking questions or designing solutions, interpreting data, and communicating with data.

Research Questions

- What impact does PL have on teachers' knowledge, skills, and beliefs; classroom opportunities to learn; and students' data fluency?
- 2. Are the PL innovations usable and feasible for the end users?
- **3.** How do teachers' and students' classroom interactions reflect the model of learning and instruction endorsed by the PL?

Project Outcomes

Professional learning modules that engage teachers in data-rich learning and cases of classroom practice.

Through active engagement with data, participants learn to:

- Hold broad notions of what counts as data
- Understand how data are collected. produced, and used
- Use digital tools to create, modify, and interpret representations and visualizations of complex data
- Ask critical questions about data that arise from personal, contextual, and historical experiences

Research that articulates:

- The knowledge and skills teachers require to support students' data fluency,
- The common roadblocks that students face, and
- An effective model of professional learning for data fluency.

Project Timeline

2022

2023

Develop Lit Review & Data Fluency Framework **Develop Professional** Learning Modules

Pilot-Test Professional Learning

Pilot Study of Professional Learning

Summer Institute

In June 2023, teachers had the opportunity to engage in adult-level learning by collecting and exploring primary and secondary data to uncover different ways human vary.

Fall 2023 Communities of Practice

Virtual Community of Practice sessions for teachers to plan, conduct, and reflect on classroom data enactments.





Describing Variability in CODAP



Forming Human Histograms

Teaching Case

Each case presents a unique story about a real learning environment, including student work and dialogue. These cases are written by classroom teachers for other teachers.

Cases support PCK by helping teachers:

- Have evidence-based conversations
- Explore common student thinking
- Grapple with teaching dilemmas





We developed and piloted a written assessment of teachers' pedagogical content knowledge (PCK) for data fluency. Early findings from the pretest suggest that this instrument effectively differentiates teachers along several dimensions of PCK.

Class Discussion To kick off the lesson, Ms. Hu Ms. Humphrey asked, "What adybug Photos and Ta



2024

2025 and beyond

Revise and Disseminate Professional Learning Modules

Revise and Disseminate Data Fluency Framework for Teaching & Learning

• Weigh the tradeoffs of instructional choices and pedagogical decisions made by other educators

Novel PCK Assessment for Data Fluency

y projected the following i notice or wonder about the	image from her comp					
	y projected the following image from her computer screen on the front v I notice or wonder about these pictures and the data table? "			At first, the students commented on the photos.		
			Kal:	Oboon! I didn't know black ladybugs existed.	Questions	
CODAP				They have different body colors, numbers of spots, and sizes.	 What knowledge or skills do these students seem to show related to using data? Provide as many examples or details as you notice. 	
	E Ladybugs		A few stu	udents talked about the relationship	Please type response here	
#3		Cases (20 cases)	between			
and the state	in- Ladybug Body color dex number	spot Number of spots color	Amari:	Row IS in the table is empty. Is that a mistake?		
	1 1 red	black	Ali: I think they left it blank because the picture of ladybug #13 doesn't have any spots. Amari: But it <i>does</i> have spots on its head. I think the person filling out the table only counted the spots on their backs.	I think they left it blank because the picture of		
	Z Z orange	black		ladybug #13 doesn't have any spots.		
#1 43 - 40	3 3 red	black				
	5 5 orange	black		But it <i>does</i> have spots on its head. I think the person filling out the table only counted the spots on their backs.		
	6 6 red	black				
	7 7 red	black				
#11 #12	8 8 red	black	A 11-	The tale and the same sight to sight our second sets		
	9 9 orange	black	All: Tr th a	them why they did that. Maybe we need to add a column for spots on their heads.		
	10 in black	Diack.			 What are some points of confusion or opportunities for further learning? Please type response here 	
and the second second	12 12 red	black				
///16	13 13 red					
	14 14 black	orange	Amari ar	Amari and Kai noticed a difference		
	15 15 black	yellow	between	the photos and the data table.		
	10 10 black	black				
#19 #20	18 18 red	black	Amari:	Ladybug #19 has 3 spots, but the table says there		
	19 19 red	black		are 6. I don't know if we can trust the table.		
	20 20 red	black	Kal	It kind of makes sense though In real life their		
1 110	#	1	Kdl.	ht kind of makes sense, though. In real file, their		
				backs are mirror images. If you see 3 spots on		
				000 5100 10010 310 0100300/ (00010 00 100		



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What Teachers are Saying

67% of participants rated the Summer Institute as "among the best PL" they have experienced.

"[I appreciated] Learning more about data analysis for myself so I'm bringing clearer knowledge to my students. I loved the habits of mind that were shared for data analysis. The CODAP program... makes it easy for [students] to construct graphical visuals of the data. This PD was very rich and I learned so much."

(TOO5)

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"I will be . . . incorporating data the first week of school. After this institute, I do not find it necessary to wait for a math or science unit to teach data in isolation." (TOO7)

Tools for Educators





