Collaborative Research: Designing Computational Modeling Curricula across Science Subjects to Study How Repeated Engagement Impacts Student Learning throughout High School (RPP)

Problems of practice

- Inequitable access to CT and CS for ALL high school students
- Teachers lack relevant PD and curricular resources to incorporate 3D NGSS learning

Problem space: Gaps in the lit

- Evidence that computational agent-based modeling supports science learning and CT (e.g., Weintrop et al., 2015; Sengupta et al., 2013; Wagh & Wilensky, 2017)
- Lack of research on impact of sustained exposure to CM across multiple subjects

Project objectives

- Develop NGSS-aligned modules with computational ABM using StarLogo Nova
- Provide PD to support teachers to use these units
- Study how longitudinal exposure to computational modeling impacts student learning; and,
- Build capacity by establishing a design collaborative between STEM Integration leaders in DCPS, teachers and researchers.

1.	Engaging students in CM to support 3
	learning & CT edcation

Design CMPs curricula for 4 subjects 3 CUs & 3 MIUs per subject; **Same MPs & CCCs across subjects**

Students engage in CMPs in class

- **RQ1: Hypothesized learning process for CMPs will support learnings of DCIs** Repeated Exposure across subjects
- of CCCs will boost learning
- **RQ1: Student learning outcomes**
- CUs will support learning DCIs & CC
- Shifts in competence with CMP's over **Greater learning gains for CCCs & CM**
- across subjects
- Positive shifts in attitudes towards s

Generative tensions

- Supporting teachers in shifting established pedagogical practices towards more NGSS-aligned instruction
- Teachers pushed for a worksheet to allow student autonomy...they were worried about "sage on the stage" but did we create a "sage on the page?"
- Meaningfully integrating science and computing into 5-day lesson sequences
- Differentiated instruction v/s generative scientific discourse for modeling instruction





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Logic model

8-dimensional	Teachers supported by involvement of DCPS members: PD led by other	2. Teachers lack r
	teachers; Curricula co-designed by district admin & other teachers	De Experience CM
5	RQ3a: Study student & teacher supports	Teachers in
r students	tedener supports	
and CCCs		RQ2:
& seeing the sam	ne set	_
	RQ3b: Develop an	
	integrative framework for	
0	3D NGSS, CM & CT	
US er a course APs with exposu	re	1. Developi r





Research considerations

- disciplines?
- modeling work over time?
- reflect 3D learning?

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• How can we track longitudinal evidence of students' learning of computational modeling practices across multiple STEM

• Pre-post unit: How do we design assessment items that allow us to trace shifts in 3D learning across disciplines? • Video data of student interaction: What are signals of shifts in students' computational Student models: How might students' models across courses change in ways that