Elementary Teachers Engaging with Learning Trajectories to Create Professional Learning Goals around Computer Science Integration

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ABSTRACT

In this poster, we present our efforts to engage elementary teachers with learning trajectories as a tool for developing both their own and their students' comprehension of computational thinking (CT) and strategies for integrating CT learning in their classroom. Eleven teachers, who voluntarily joined a teacher professional development (PD) program to develop teacher leaders for CT integration in the elementary context, attended a one-day PD session aimed at reviewing their knowledge of CT, participating in CT-infused lessons, and engaging with CT learning trajectories. Over the next year, teachers will participate in monthly virtual PD to continue to grow both their CT content knowledge and pedagogical knowledge. Our goal is to develop these teachers as teacher leaders who will support others as they integrate CT. This poster will show our current progress on CT learning trajectories and teacher leaders' responses to the tool.

CCS CONCEPTS

• Social and professional topics -> Computing education; Computing education programs; Computer science education

KEYWORDS

Teacher professional development, computational thinking, learning trajectories, elementary computer science education

1 INTRODUCTION

The paper "STEM Education for the Future: A Visioning Report" [1], claims that "technology holds promise for creating equitable learning environments, but it also alters the skills we need in the future, and changes what and how we teach" (p. 24). Computational literacy, particularly in K-6 education, helps students build the necessary problem-solving and critical thinking skills to solve future problems [2]. To support teachers' professional learning around CT, they must have opportunities to practice the cognitive processes and activities in which they will engage students, but at a level tailored to their capacities as adult learners [3]. Additionally, teachers need opportunities to both investigate models of the instructional practices they are learning, and to enact those practices in increasingly complex environments [4]. This poster describes part of an ongoing teacher PD project for elementary teacher leaders.

2 BACKGROUND

In this section, we provide a brief background around teacher PD and teacher learning trajectories (LTs).

2.1 Teacher Professional Development

Research suggests that educational environments that center on students' funds of knowledge can improve equity in STEM disciplines [5]. To build culturally responsive, CS-infused curriculum, educators must understand their students' funds of knowledge and use them to position students as co-constructors of learning experiences that value home and community knowledge [6]. Aguirre et al. [7] suggest that teachers need multiple supports to use funds of knowledge as a regular part of curriculum design, including creating lessons that emphasize students' experiences, and STEM practices in the community setting.

2.2 Learning Trajectories

Learning trajectories (LTs) are ways of thinking and understanding a concept over time through interaction with specialized curricula and activities. As part of our MakingCT project (NSF #1923503), we developed a set of CT LTs for teacher CT integration development. They describe ways teachers think about CT integration in their classroom, including how to respond to students' thinking. The use of LTs in teaching and learning, and specifically in teacher development, has shown positive learning outcomes [8]. This poster will elaborate the CT LTs used during the teacher leader professional development and how the teachers plan to leverage them in their teaching as part of our UnboxingCT project (NSF #2300322).

3 METHODOLOGY

To understand teachers progress as they integrate CT into their disciplinary teaching, especially using LTs that describe how instruction may support students' knowledge of CT over time, we introduced teachers to CT LTs. Data from their self-reported perceived understandings of CT and conceptual thinking analysis of video-recorded PD sessions was used to inform teacher leader's initial impressions and potential uses of the CT LTs as both ways to direct their own growth and to support other teachers' development towards CT classroom integration goals.

Table 1. Selected Levels of Teacher LT for CT

Level	Level Description/Goal	Sample Teacher Practices for Observing Development
2	Able to teach existing lesson integrating CT	-Defines CT as specific concepts and/or practices -Teaches existing lesson with no or limited modifications (e.g., chunking lesson for time, classroom management)
3	Able to modify and co-create lessons	-Defines CT as problem-solving practices -Modification of existing lessons based on student CT learning needs

Video and audio recordings were transcribed and analyzed using qualitative coding techniques to investigate how teachers engaged with the LTs and their perceptions of the LTs to potentially set professional learning goals and reflect on practice. To preserve inter-rater reliability, two team members performed line by line process coding.

4 POSTER CONTENT

4.1 Evidence for learning trajectories

The teachers were asked to sort the "level descriptions" for the current LTs together in groups of 3-4 participants. Next, we shared how we currently organize them, and discussed similarities and differences. Initial analysis shows that many teacher leader groups did not organize their LT "levels" in the same way that the research team did. Many cited "Blooms Taxonomy" levels and "Depths of Knowledge" (DOK) as their method for organizing the levels and justified their thoughts by referencing that the looked at the "verbs". Then teachers discussed LTs in the context of CT-integrated lessons and how they may teach them in their classrooms. Teacher reflections also demonstrate how teachers used teacher LTs to understand their own learning: "The learning trajectory information was new and useful to think about. I have been thinking of coding paths for my students. The trajectory framework will help me to focus on what I want the students to learn and what's next."

4.2 Conclusions

Our initial work suggests that LTs can effectively support the design of integrated teacher learning experiences, as well as the practice of helping teachers categorize and examine their own learning about CT. Future research will unpack how teacher learning develops over time, and the ways that student LTs can help teachers understand student learning.

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