JRST
Journal of Research in Science Teaching
Research Brief
VOL. 60, NO. 6, PP.1353-1384 (2023)

Teachers Learn to Integrate Computational Thinking into Data Practices

Erin Peters-Burton, Peter J. Rich, Anastasia Kitsantas, Stephanie Stehle, & Laura Laclede

Overview: Biology teachers integrated computational thinking practices with data practices in their lessons. They focused most on integrating decomposition and pattern recognition with creating and collecting data.

AUDIENCE: Teacher organizations; Education policy makers.

KEY POINTS

- Teachers already knew a great deal about decomposition and pattern recognition. Abstraction and automation were novel ideas when presented during professional development.
- Teachers reported high efficacy for computational thinking following professional development and continued to maintain high levels after teaching computational thinking to students during data practices.
- Teachers integrated all of the computational thinking practices in all data practices but focused more on decomposition and pattern recognition because they were already familiar with them.

INTRODUCTION There are opportunities during science instruction, such as when teaching students to employ data practices, to apply computational thinking (CT), that could potentially enhance instruction in both computational thinking and the science content. By defining interactions between their current curricula and computational thinking, educators might be able to identify effective methods for integrating computational thinking into their teaching.

FINDINGS Biology teachers readily identified opportunities for decomposition and pattern recognition in all lessons. In general, biology teachers employed pattern-finding practices in turn with each of the different data practices fairly equitable, except for creating data. This is in contrast to decomposition, where pattern-finding was heavily employed when looking to create data and hardly employed when collecting data. Biology teachers struggled to understand or know how to use abstraction in their lessons. Teachers offered a solution to assist in understanding—provide more examples. Biology teachers' integration of algorithmic thinking revealed an interesting pattern: they used algorithms heavily in thinking about data creation and used it only once (across five lessons) when visualizing data. Thus, biology teachers may have seen algorithms as helping them to frame and interpret their problems, focusing on existing formulas as well as how to conceptualize their scientific inquiries. Biology teachers' lesson plans showed less evidence of automation than any other CT practice. There was only a single instance of automation being used and this single instance was used to analyze data.

TAKEAWAYS Researchers recommend that in order to diversify CT across disciplines and students, educators need to first have the opportunity to engage in professional development to learn what CT is and how it can be implemented in curriculum. These professional development experiences should be ongoing across the school year. In addition to these findings, we found that science teachers easily integrated decomposition and pattern recognition, and found algorithmic thinking, abstraction, and automation to be more difficult to integrate. We recommend that professional development experiences take this into account and begin to engage teachers with integrating decomposition and pattern finding first, then build up to integration of algorithmic thinking, abstraction, and automation with support and examples. Finally, given that teachers reported lower efficacy beliefs for supporting struggling students, cultivating teacher efficacy via professional development workshops might help teachers develop a healthy sense of efficacy in CT integration with data practices in science investigations.

Full Title: High School Biology Teachers' Integration of Computational Thinking into Data Practices to Support Student Investigations