



Computing in Data Science or Data in Computer Science?

Exploring the Relationship between Data Science and Computer Science in K-12 Education

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ABSTRACT

Data literacy is quickly becoming an essential topic for all students to learn in order to succeed in an increasingly data-driven world. Foundational data literacy skills currently live in a number of subjects across K-12 (e.g., data collection and analysis in science classes, statistical calculations in mathematics/statistics, data visualization and communication in civics/social studies), however, a growing number of schools and districts are introducing stand-alone data science (DS) courses. Given the centrality of computing and programming in the contemporary practice of DS, many of these courses include topics historically reserved for computer science (CS) classes. Further, many CS courses include dedicated time for DS topics (e.g., AP Computer Science Principles' unit on Data). In many ways, DS educators and CS educators are working towards the same ends in complementary ways. However, at other times, the two disciplines are in tension, especially given the scarcity of time in K-12 student schedules for non-core subjects. This panel will explore what DS education and CS education can learn from each other, how each can contribute and advance the goals of the other, and how these two intertwined disciplines can productively live alongside each other in K-12 settings.

CCS CONCEPTS

- Social and professional topics → Computing education.

KEYWORDS

Data Science Education, Computer Science Education, K-12

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1 PANEL SUMMARY

We are living in an increasingly data-driven world. At the heart of the data revolution are technologies and ideas drawn from computer science (CS). Despite this fact, contemporary data science (DS) concepts and practices are rarely incorporated into K-12 CS education. This is in part due to the relative recency of the ascendance of DS but also due to questions of disciplinary boundaries and the challenge of the rapidly expanding scope of CS. As a result, the emerging K-12 DS education movement [3, 4] is happening in parallel to recent K-12 CS education efforts [1, 2].

This panel will explore the relationship between the current state of K-12 CS education and the emerging K-12 DS education movement. While there are reasons for DS and CS to be taught independently there are also potentially powerful intellectual and practical reasons to integrate the two. Given K-12 education's goal of preparing youth to be informed citizens and recognizing the growing importance of both CS and DS, bringing these two fields together may help prepare youth to succeed in a computational and data-driven world.

The panel will start with an overview of the current state of K-12 DS education followed by short remarks from the moderator and panelists on their work at the intersection of DS and CS education in K-12 contexts (10 minutes each). The audience will be invited to discuss in small groups to generate and refine questions for the panel (5 minutes). The remainder of the session will be a moderated discussion weaving together audience-generated questions with discussion topics chosen by the moderator (30 minutes).

2 POSITION STATEMENTS

2.1 Zarek Drzoda (Moderator)

K-12 DS is growing rapidly: from 2019 to 2023, the Data Science 4 Everyone community grew from ~200 to 3,000 community members, from 1 to 17 states, and now includes over

70 K-12 programs. Recent national research convenings for DS education facilitated by the Institute of Education Sciences (2021), the National Academies of Sciences, Engineering & Medicine (2022), and the National Science Foundation (2023) have helped to further advance the goals of K-12 DS education. These efforts were made possible by the research and community infrastructure for K-12 CS education and concurrent initiatives to diversify K-12 mathematics with a greater emphasis on statistics, data, and technology. Critical decisions lie ahead for K-12 DS, including: Where in the K-12 schedule DS “fits”? How to best capture public and policymaker interest in DS, AI, and emerging technologies? and How to operationalize DS in K-12 education?

Zarek Drozda is the Director of Data Science 4 Everyone, a national initiative and coalition based at the University of Chicago. Zarek has worked at the intersection of applied research, data, and policy, including work at the U.S. Department of Education, Data Lead for the U.S. National COVID Response, and as an Analyst at the Center for RISC.

2.2 Kathi Fisler

Teaching DS and CS together, in an interwoven fashion, can address challenges that each area faces independently. From a content perspective, bringing DS into CS creates compelling real-world scenarios for basic programming tasks while also enabling discussions of ethical and responsible computing. Bringing CS into DS provides students with agency in data analysis and provides concrete ways to explain what it means to test computed results for accuracy. From a policy perspective, CS already has national standards with mandates in some states; including DS in computing makes it easier to deploy DS initiatives. Embracing the connections between CS, DS, and mathematics offers a way to increase the footprint of both CS and DS in K-12 courses without the need to revamp requirements.

Kathi Fisler is a Research Professor and co-Director of Undergraduate Studies in Computer Science at Brown University. For the last 5 years, Kathi has been developing and teaching an introductory CS course that integrates DS and computer science at Brown. Kathi exchanges ideas between this work and her long-standing K-12 work with Bootstrap, a program for K-12 teachers who wish to integrate computing and/or DS into their courses.

2.3 Justice Toshiba Walker

Situating DS in CS continues to draw attention as a viable frame for productive and agentic learning—given the potential of computing as a tool for accessing, processing, and analyzing data at scale. While research and education efforts show promise there are persistent concerns about the restrictive nature of activities

that involve pre-generated data sources. During this panel, I will share a perspective we call ‘Sandbox Data Science’—an approach that centers learners as agents in DS as CS— along with lessons learned from our work on the co-design of the Coding Like a Data Miner project.

Justice Toshiba Walker is a Learning Scientist and Assistant Professor of STEM Education at the University of Texas at El Paso, the nation’s leading R1 Hispanic-Serving Institution, where he leads the ABC Learning Lab and its emphasis on learning technologies that leverage next generation bio and computing tools. His research examines how youth respond to learning paradigms that emphasize cultural relevance, epistemological agency and critical literacies.

2.4 David Weintrop

Today’s youth are growing up surrounded by data. However, the ways youth experiences are shaped by data and the data youth create and often not fully transparent to the youth themselves. This lack of awareness and visibility can be problematic due to bias in how data is collected and used. At the same time, the data youth create and consume can serve as a compelling context for DS and CS learning in a way that resonates with their interests, identities, and experiences. As part of this panel, I will present emerging findings from the API Can Code project that situates DS and CS in the lived experience of today’s high school students.

David Weintrop is an Associate Professor in the College of Education and the College of Information Studies at the University of Maryland. His research focuses on the design, implementation, and evaluation of effective, engaging, and equitable computational learning experiences.

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