DATA SCIENCE EDUCATION K-12

INDIVIDUAL SHOWCASE: Depicting Data Conversations for ELA Teachers through Routine Supports

Victor R. Lee, Stanford University, vrlee@stanford.edu,
Elizabeth Finlayson Harris, Stanford University, harrislz@stanford.edu
Christine Bywater, Stanford University, cbywater@stanford.edu
Sarah Levine, Stanford University, srlevine@stanford.edu
Dorottya Demszky, Stanford University, ddemszky@stanford.edu

Session Description

Teachers outside of STEM areas have highly varied prior experiences learning about and teaching with data but are increasingly being asked to teach with and about it. Responding to this lack of support, we present an instructional routine resources for English Language Arts (ELA) teachers as they strive to incorporate data science into their classroom practice. Using data conversation depiction comics, we showcase a variety of instructional practices to provide teachers with sequential images of how to teach with data in conjunction with other disciplinary learning goals. As we devise more ways for data literacy and data science to interface with other subject areas, this represents a relatively low-cost embodiment of key ideas informed by prior the scholarship on educative curriculum materials.

Objective

With the call to integrate K-12 data science education with teaching across disciplinary subjects (Jiang et al., 2022), a new demand is being placed on teachers. Specifically, teachers outside of STEM subject areas have highly varied prior experiences with data and with teaching about data. However, teachers are increasingly being asked to teach with and about it. While this invites reimagining pre-service teacher training (Lee et al., 2024) and in-service teacher professional development, we need to deploy a multitude of ways to facilitate teaching with and about data in non-STEM fields. This individual showcase shares a form of teacher support that we have been developing as part of a larger project to mutually support the development of literary and data literacies in middle school English Language Arts (ELA) classes.

Perspective

Curriculum materials, in addition to embodying tasks and activities that can yield rich learning experiences for students, have been recognized also as a support for teacher learning (Ball & Cohen, 1996). Specifically, Davis and Krajcik (2005) have advanced the idea of educative curriculum materials (ECMs) - intentionally designed supports for teachers' pedagogical content knowledge that are embedded in other curriculum materials. For example, these can take the form of notes about common student preconceptions, challenges students will raise in a class discussion, or samples of student work and how to recognize and encourage different forms of disciplinary reasoning. Davis and Kracjik specify key features for ECMs such as needing to help teachers anticipate learners' responses, supporting teachers' content knowledge development, and showing teachers the connections to other units and materials in a curriculum. In subsequent work, Davis et al (2017) noted that designing curriculum materials as ways of illustrating teaching practice was especially valuable for their uptake and usability.

With that in mind, we have focused on the design of instructional routines (see Figure 1) – reusable classroom activities that can be executed in the span of minutes. Our instructional routines are intended to promote engagement in specific epistemic practices and also embed ECM features. A specific direction we have taken, and have been enthusiastically received by district collaborators, is the use of comic strip depictions of ELA data conversations in action (Figure 1). Comics were ideal as an instructional resource due to their high accessibility for showing sequences of events in graphic form while strategically using space (McCloud, 1993). We also observe that there are other works in data science education that similarly find data and comics can be effectively combined as a mode of storytelling and communication (Tes et al., 2023). Our work differs from those projects in that we are focusing on comics as part of ECMs.

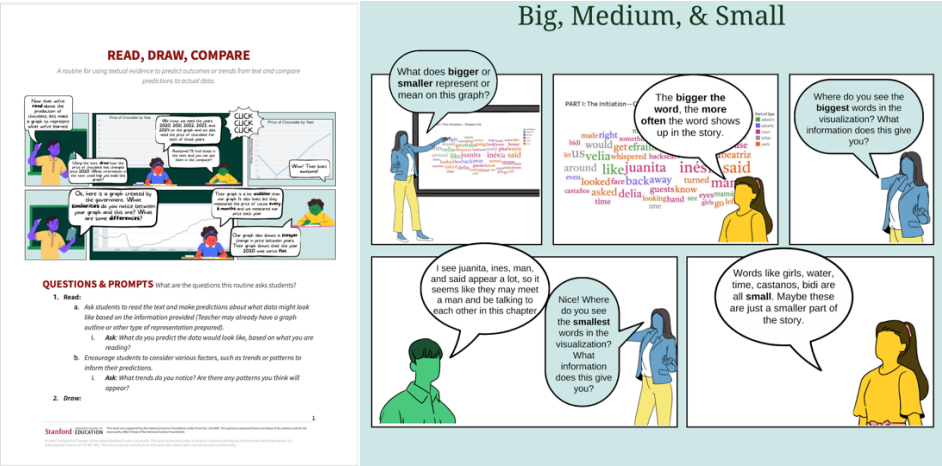

Figure 1. Sample ELA data routine document (left) and an expanded comic for the "Big, medium, small" routine (right).

To further maximize compatibility with teachers' expectations and preferred formats, we model our routines in ways that bear resemblance to Project Zero's (PZ) Thinking Routines (Project Zero, 2022). PZ similarly aims to encourage students to participate in specific epistemic practices. Like PZ, our routines explicitly provide statements of purposes and possible prompts for teachers to use. However, given our data focus, we also include specific statements for how data visualizations and classroom circumstances align best with a given ELA data routine.

Project Context, Methods, and Data

The larger project in which this routine and comic ECM design work is situated is the "ELAlytics" project (NSF Grant no. 2241483; elalytics.stanford.edu) which involves iterative co-design of data visualizations and activities using middle grades literary texts as sources. It is inspired by the development of digital humanities and novel approaches to visualizing features of text that ultimately contribute to natural language processing and text analytics. Through recorded monthly co-design and professional learning sessions with teachers and district coaches (Lee et al., 2024), we identified a set of learning needs around the integration of data visualization in ELA instruction. Ideas are generated through co-design sessions, and then prototypes are brought for review, critique, and revision. Along with the continuing co-design work, we are also analyzing student interviews (Coelho et al., 2024), classroom interactions (Miller et al., 2024), and other records to understand the opportunity space for data and middle school ELA integration.

Implications

We view ELA data routines and the depictions of instructional practice as an easily replicated way to provide teachers with some sequential image of how to teach with data in conjunction with other disciplinary learning goals. While they have only been used with a small team thus far, the reception from collaborators has been enthusiastic as it helped show what to do during instruction in a concise way. As we devise more ways for data literacy and data science to interface with other subject areas, this represents a relatively low-cost embodiment of key ideas from prior scholarship on educative curriculum materials. Future work can explore the overall effectiveness of this embodiment for building teachers' pedagogical content knowledge and affecting how they facilitate lessons in their classes. Supporting teachers in this new type of pedagogical work will continue to be an important way to address a fundamental human dimension of data-integrated instruction.

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