Teachers' reasoning regarding data-driven instruction in the biology classroom

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by

Carmel Bar

Advisor

Anat Yarden

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Summary

In today's data-driven world, possessing data literacy is essential for effective analysis and interpretation of information. Incorporating data literacy into education is imperative to equip students with the practices and knowledge necessary to succeed in STEM fields and beyond. Unfortunately, authentic data analysis in the classroom is still largely overlooked in high school education, with most current uses of data in biology classrooms being overly simplified, and little is known regarding high school biology teachers' data reasoning. Understanding teachers' reasoning is important because it can shed light on what teachers notice, value, and see as important for students to learn.

Department of Science Teaching, Weizmann Institute of Science

To examine high school biology teachers' reasoning as they design and engage in data activities, I first developed instruction units suitable for the high school biology curriculum using authentic data. Then, I conducted professional development courses for dozens of biology teachers, which allowed me to learn how biology teachers act as learners and as designers of data-rich instruction units. My research tools are based on artifacts collected during professional development courses, open and closed questionnaires, case studies, and teachers' written reflections from 2020-2021.

My findings suggest that dataset-driven instruction promotes the asking of high-order research questions among teachers. I found that when teachers design instruction units based on datasets, they are richer in scientific practices and knowledge types, compared to activities based on simpler data sources such as simulations or textbook data. While teachers acknowledge the benefits of authentic datasets, they still find dataset-driven instruction challenging and do not introduce the datasets to their students. Barriers to the implementation of dataset-driven instruction include cognitive overload, divergence from traditional curriculum, lack of time, technological challenges, and affective aspects.

In addition, I propose design principles for dataset-driven instruction units, focusing on the authenticity, size, variability, and accessibility of scientific datasets. I also suggest that future professional development courses should explicitly discuss how scientific practices and knowledge considerations can be expressed in dataset-driven instruction. This study highlights the benefits and challenges of dataset-driven instruction and the need for additional support for biology teachers in designing and implementing instruction units based on authentic data. Introducing data literacy in biology education and integrating it seamlessly into the curriculum is essential and requires the support of all stakeholders, with special attention to biology teachers.