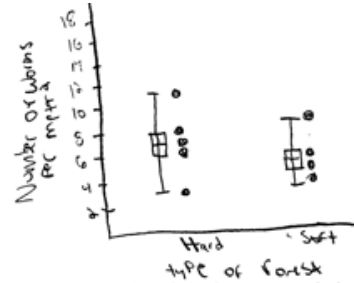


The Data Literacy Project

Data literacy is the ability to address a question using data as evidence that supports an answer. It is the ability to make sense of data and graphs by turning a set of systematically-collected measurements into scientific ideas. Data literacy skills involve collecting, organizing, and summarizing data, displaying data meaningfully in graphs, interpreting the graph in terms of the question, and communicating those ideas to others – all skills that are included in the Common Core Mathematics and Next Generation Science Standards.

Do hardwood and softwood forests tend to have the same abundance of earthworms?

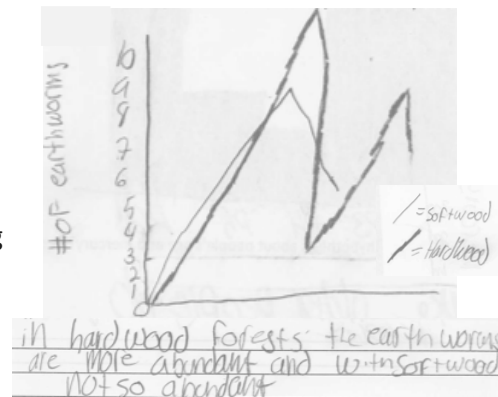
Area	Number of earthworms	Forest type
A	6	Hardwood
B	11	Hardwood
C	4	Softwood
D	3	Hardwood
E	9	Softwood
F	6	Softwood
G	8	Hardwood
H	5	Softwood
I	7	Hardwood



"My graph shows that there is an equal abundance of earthworms in both types of forests because the boxes overlap."

The Data Literacy Project is a four-year commitment by the Schoodic Institute and the University of Maine to increase the use of data, graphs, and evidence as means for students to learn science content and communicate scientific ideas. We work with teachers and administrators from selected local school districts to provide professional development workshops and data resources that are relevant to classroom curricula in math, science, and social science courses. The project is funded by the Maine Department of Education Math-Science Partnership through a grant to the SERC Institute. It is one of several learning partnerships sponsored by the Schoodic Institute designed to engage students in real and meaningful research in their own watersheds and communities, in partnership with scientists at the University of Maine and local teachers.

Why Data Literacy? Although core concepts in data analysis and graphing are part of middle and high school science and mathematics standards, many students do not have regular practice applying those skills independently in open-ended investigations in science. For example, students in both middle and high school are often unsure about what kind of graph to make given a particular research question. They are uncomfortable with data that are variable – a characteristic of data that scientists routinely expect, describe, and discuss, and sometimes study. We have observed that many middle and high school students do not have language to describe variability, to compare two groups in a single variable, to describe correlation between two variables, or to describe how something



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(updated 2/6/14)

changes through time. Many of the teachers in our sessions are eager for a framework and language to help their students apply data-related math skills to their investigations in science class.

Goals

- Support the use of data as evidence in classroom teaching of science, math and other subjects.
- Enable development of a shared language to use in working with graphs and data with students, as well as shared expectation about learning sequences across different grade levels.
- Provide teachers with a framework and different ways to explore and teach core concepts that support the use of graphs and data in the context of science learning.
- Develop and support the use of informal assessments to follow students' progress toward mastery.
- Open the door to an ongoing informal learning community made up of teachers who are interested in working more with data in math, science, technology, and social science programs.

What got us started?

When students undertook field-based watershed research projects with partnering teachers and researchers, we observed gaps in their ability to use data and graphs to display evidence and communicate scientific ideas:

- Given a research question, many students had no framework for choosing what kind of graph to make;
- Many students did not understand the importance of recognizing variability in a data set;
- Many students lacked language for describing and interpreting graphs;
- Many science teachers were not sure what graphing skills students can be expected to have;
- Many science teachers were not sure how to help students apply graphing skills learned in math class to questions and real data sets about the natural world;
- Many students thought of making a graph as an endpoint, rather than as a necessary step on the way to displaying and interpreting evidence about a claim.

The language of data and graphing is central to scientific practice, thinking and communication, and plays a key role in the Next Generation Science Standards. Also, fundamental concepts of recognizing statistical questions (“How tall am I?” vs. the statistical question “How tall are the students in my class?”), variability, frequency plots, group comparisons, and bivariate correlations are all part of middle school Common Core Math standards. The Data Literacy Project focuses on applying these math skills *in the context of science learning*.

Our approach

- We emphasize the application of mathematical skills and concepts in science learning: (1) anticipating, describing, and explaining variability in a data set, (2) univariate group comparisons, (3) correlations between two numeric variables, and (4) describing trends and patterns in how something changes through time.

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- We use real and current data sets to engage students in questions about their world.
- We work with teachers to create or adapt instructional and practice mini-lessons they can use in class that are designed to help students practice specific data and graphing skills and develop language for talking about data.
- We use real data as a foundation for learning about science and math content.

What evidence do we have that our approach can help students?

Participating teachers are adapting the Data Literacy framework and materials to support their curriculum. Teachers report that students are engaged by questions about current and locally-relevant data sets such as local weather, stream-flow, marine buoy data, data about local towns and counties, Maine fisheries and wildlife, lake ice-out data, data about cars, hurricanes, earthquakes, health, diseases, and current social fads. They relate to data from places and populations that are familiar to them.

Teachers are piloting several short pre-post surveys designed for classroom use to assess students' understanding and skills before and after instruction and to give students practice working with data. Preliminary survey results and qualitative feedback from teachers suggest that students' data and graphing skills can improve using the Data Literacy framework and classroom resources.

Workshop evaluations and our observations suggest that participating teachers improved their own data skills, vocabulary, and pedagogical content knowledge by exploring small and large data sets that relate to curriculum topics they teach, by adapting mini-lessons to support their curriculum, by repeated student practice using graphing and data software, and by reviewing and discussing samples of students' work with project staff and teaching colleagues.

What do we offer?

Currently we are working with a small team of teachers in Maine who are piloting Data Literacy framework, classroom resources, and formative assessments during the 2013-2014 school year and logging results. During the last three years we have provided:

1. Extended, committed professional development in Data Literacy for school or district (interdisciplinary) Professional Learning Communities.
2. An introductory session (1.5 to 2.5 hours) to provide an overview of core data literacy concepts, common gaps in skills and understanding, our framework for teaching strategy, and our web-based resources. While we have worked primarily with middle and high school teachers, building data and graphing skills and language begins in elementary school; we are interested in working with elementary-level teachers.
3. 2011 and 2013 Summer Institutes: Four days at Schoodic Institute combining strategies for guiding students in field research and in applying data and graphing skills to student research projects and other web-based environmental data sets. We offered a Summer Institute at the Schoodic Education and Research Center August 19-22, 2013. ("**Changes through Time: Using data to identify patterns and trends**").
4. A Web-based library of current data sets and data literacy mini-lessons, and links to relevant Common Core Mathematics and Next Generation Science Standards.

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6. (Future: Live or Webinar-style online Data Literacy workshop/course for teachers)
7. (Future: Published guide or primer for incorporating data literacy into science teaching)

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The Data Literacy Team

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