Teaching Data Literacy with Creativity:

The Dear Data Project in Middle School

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ABSTRACT

Building opportunities for students to interact with data in creative and novel ways builds curiosity, engagement, and data literacy skills. During participation in an NSF Research Experience for Teachers program, we focused on building our skills with data collection, analysis, and visualization. Dear Data was a key text used to help us explore data in a different way. In this article we provide three ways to implement Dear Data concepts in the middle school classroom, each with a different time commitment. We have found these activities engage students deeply, and the creativity of their work reflects this engagement.

KEYWORDS: Data Collection; Data Analysis; Data Visualization; Data Interpretation; Data Literacy; Analyzing and Interpreting Data; Obtaining, Evaluating and Communicating Information; Data Detectives

Data literacy is essential for 21st-century students, equipping them to navigate an increasingly data-driven world (Witte, Schwering, and Frischemeier 2024). For middle school teachers, introducing data collection, data visualization, and data interpretation can be daunting. What do students already know? How much should be covered? How can we, as teachers, engage them effectively? As both a state assessment requirement and a life skill, data literacy needs to be more than just another lesson—it needs to be pervasive within the curriculum and inspire curiosity and understanding.

In the summer of 2024, we participated in the Research Experiences for Teachers Sites in Biological Sciences (BIORETS) program in Tucson, Arizona at the University of Arizona. Through this program we conducted research along the Santa Cruz River, a riparian ecosystem within the Sonoran Desert, and participated in professional development that focused on data literacy, nature journaling, and bringing the local river ecosystem to the classroom. Our exploration of data literacy provided a progression for what students should know at each grade level (Hunter-Thomson 2021; see also Building Data Literacy Skills in Online Resources). Our new-found understanding of the essential data literacy skills inspired us to develop multiple approaches to provide our students with repeated practice using skills that included data collection, analysis, and visualization activities.

In this article, we describe three separate approaches. Aaron Buckley describes Data Detectives: Inquiry and Visualizations, lessons implemented weekly, 25 minutes a day across four days, with subject material available for a full year (see Online Resources). Crystal Shepard discusses a quarterly homework project for all of her students. The final lesson is a "get-to-know-you" activity that is easy to implement with minimal supplies and planning (see Online Resources). The lessons address two *NGSS* Science and Engineering Practices: analyzing and interpreting data and using mathematics and computational thinking. Also addressed are *NGSS* crosscutting concepts: pattern, cause and effect, scale, proportion and quantity, and stability and change. Many Common Core math standards across the middle school grade bands are also covered.

What is Dear Data?

The Dear Data project (see Online Resources), created by information designers Lupi and Posavec (2016), was a year-long analog data collection and visualization exercise. These designers collected personal data weekly and transformed it into hand-drawn postcards that they mailed to one another. The results were a blend of art, storytelling, and data science.

This inspired us (Aaron Buckley and Crystal Shepard) to bring Dear Data into our classroom as a weekly activity for Buckley and a quarterly homework assignment for Shepard. These activities have helped students gain an understanding of how to collect, organize, and analyze data, as well as encouraging them to express their individuality through artistic visualization of data, moving data from a somewhat abstract science concept to a representation of their personal experience.

Implementing weekly Data Detectives lessons (25 minutes per day/4 days—Buckley)

Introduction and inspiration

At the beginning of the school year, I introduce Dear Data by showing examples of data created by the original creators, Lupi and Posavec (2016). I then explain to my students that each week they will be introduced to a different data set, which they will discuss, analyze, and visualize.

Each Data Detectives lesson follows the process outlined below, with the entire project taking about 25 minutes of four class periods, typically in one week. The author implemented this within an enrichment class, as a supplement to core science and math instruction. However, the material can be adjusted to fit into different time frames: as a warm-up or bell work activity, in a block schedule, or as a weekly enrichment across a month. In addition, the concepts and structure can be used within a science curriculum to deepen student engagement. For example, students could gather and graph daily temperature in a unit on thermal energy or the seasons.

Day 1: choosing a data topic and data collection

The data for each week is predetermined. I gather data from various sources including attendance data, pet types, shoe color, and so forth. As often as possible, I include students on data collection so that they can practice data collection skills as well. If scaffolding is necessary, data can be collected as a class, in groups, or as partners.

Day 1 into day 2: analyzing the data

Once the data has been collected, students work in groups to analyze the same data set, practicing critical data literacy skills. Students are given the following prompts: What do you see? Is there a pattern? What parts of the data are surprising or unusual? Students then share their findings with the class. As part of the analysis, the students graph data using standard graphing methods including bar, histogram, pie chart, and so forth. This can sometimes help students see patterns that they didn't see in the raw data. For students who struggle with graphing, this can be done as part of a class or group. Students can also be given a list of graph types to choose from that are appropriate for the data that was collected.

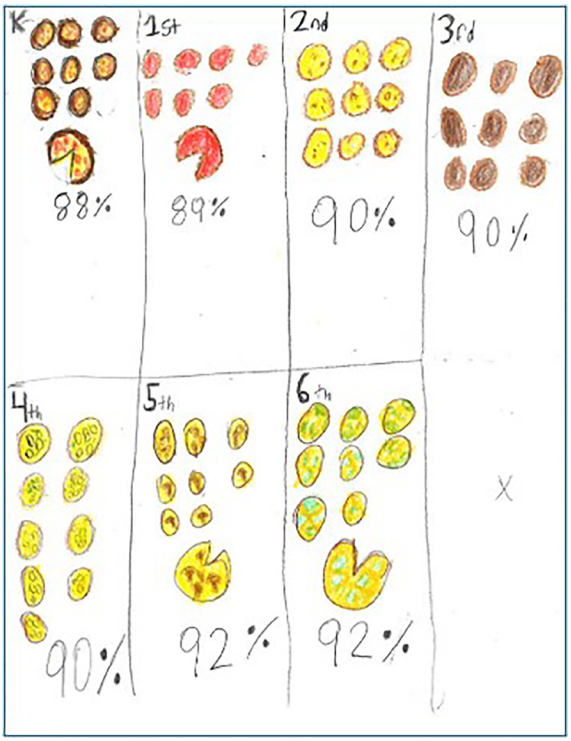
Day 2: brainstorming data visualizations

Once students have familiarized themselves with the depth and spread of the data, they begin to brainstorm the possible ways they can display their data. Students choose a method of displaying data that utilizes art and steps away from the most common ways data is displayed (i.e., graphing). To help facilitate this process at the start of the school year, students are given time to share ideas about how they might visualize their data. For example, when reviewing school attendance data, one student stated that they thought of pizza since pizza is every student's favorite food (see Figure 1).

Day 3 and day 4: designing data visualizations

Students then visualize the data in a novel way on a full sheet of blank paper. As part of the process, students write an explanation of the data off to the side of their drawings. This way, observers can gain an understanding of how the student chose to represent the data, as well as gaining an understanding of the importance of visual keys and proper labeling of legends on graphic representations. While visualizations can be done as a group, this presents its own set of challenges. I recommend visualizations be done individually; a scoring rubric for visualizations can be found in Supplemental Materials.

FIGURE 1. Sixth-grade student visualization of school attendance data by grade with different types of pizza (one pizza equals 10 percent).



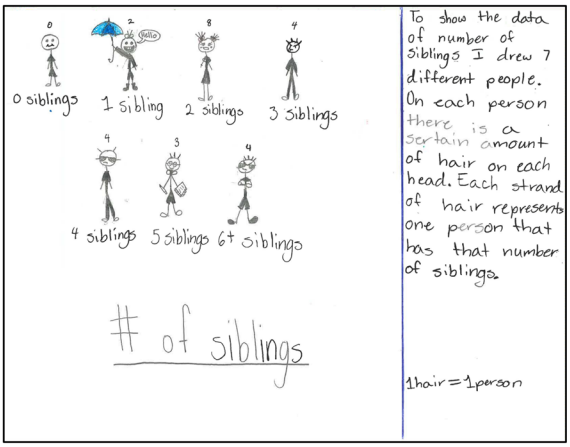
Day 4: gallery walk

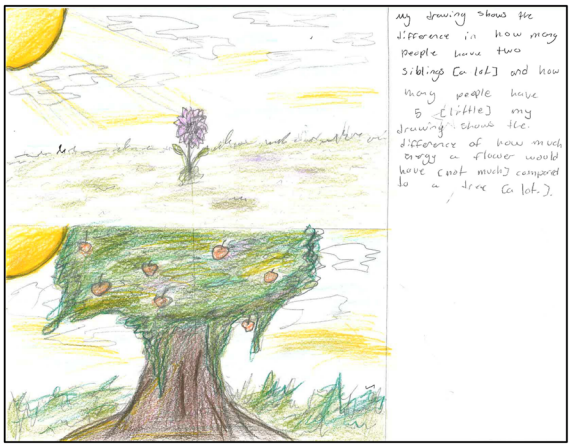
Student visualizations are displayed in the classroom so that classmates are able to view and interact with each other's products. Students are encouraged to interpret the data representations to understand how the creator viewed the data. Student examples of the same data set are often very different (see Figure 2).

Possible extensions

To support students' mathematical development, there are a variety of extensions that could be implemented. For example:

FIGURE 2. Two sixth-grade students' data visualization of the number of siblings each student in class has. The examples show very different student interpretations of data visualization.





Ask students to develop questions about their graphed data: what is the ratio of kindergarten to sixth-grade students present at school?.

Encourage students to develop a line of best fit.

Ask students to develop questions about another student's data.

Utilize mean, median, and mode to further analyze the data.

Implementing Dear Data as quarterly homework (two lesson days per quarter—Shepard)

Each quarter, my students embark on a Dear Data journey as a homework project. The activity has high levels of engagement across all learners. Students with Individualized Education Programs (IEPs) and English Learners (ELs) successfully engaged in this activity by collecting data based on their own preferences and interpreting it in ways that suited their learning needs. This approach allowed them to demonstrate their understanding of the material while accommodating their unique learning styles and abilities.

Day 1: introduction and inspiration

During a class period, I start with a slideshow explaining the concept of Dear Data. Students learn that it is about turning everyday information, which we consider data, into a visual story that is not a graph or chart (see Figures 1 and 2). The data is not portrayed as numbers, and students' products often resemble art more than traditional data visualizations. I showcase examples from the original creators, Lupi and Posavec (2016), as well as examples from previous students. I use about half a class period for the introduction of the homework project. Students are given one week to complete the assignment.

Homework: choosing a data topic and collecting data

Students pick a personal activity or habit to track for a week outside of school. Popular topics include time spent on homework, steps taken daily, favorite snacks eaten, or sporting event outcomes. Providing a list of suggestions helps spark ideas (see "Data Collection Topics and Ideas" in Box). To maintain privacy and safety, it is essential for students to refrain from collecting any personal information that could directly or indirectly identify individuals or reveal sensitive aspects of their home situations. This includes avoiding the gathering of names, contact details, addresses, or any other data that could compromise anonymity or privacy. There is a check-in with students midway through the week to make sure they are collecting appropriate data.

Data Collection Topics and Ideas

Dice rolls: Number of rolls, what numbers are rolled

School break activities: What students did on break or weekends

Pets: Type and quantity

Siblings: Number of siblings, ages (see Figure 2)

Daily steps: Steps per day over one week or average steps per month

Music preferences: Favorite genre and/or time spent listening

Attendance data: By grade level or class

Class sizes: Number of students per grade

Shoes: Color, type, brand, and quantity

App usage: Time spent or frequency

Note for teachers: To maintain privacy and safety, it is essential for students to refrain from collecting any personal information that could directly or indirectly identify individuals or reveal sensitive aspects of their home situations. This includes avoiding the gathering of names, contact details, addresses, or any other data that could compromise anonymity or privacy.

Homework: Designing Dear Data visualization

Using a postcard-size piece of cardstock (8.5″ × 11″ cut into quarters), students transform their data into artistic representations. I emphasize the importance of creative expression, encouraging them to use shapes, patterns, and colors to encode their data visually. This is done as homework, not in the classroom.

Requirements: creating a key and explanation

On the back of their cardstock, students create a key explaining their visualization. The key includes:

title—a name for their data project.
details/key—explanations for different patterns, colors, and shapes used.
data table—a table summarizing their collected data for clarity (see Figure 3).

Day 2: gallery walk with peer interaction

Once the homework is turned in, we spend a class period where students display their Dear Data postcards on their desks. Their peers walk around the classroom, attempting to decode the visuals before flipping the card to reveal the key. This activity fosters discussion, critical thinking, and appreciation for each other's creativity. See link to scoring rubric for visualizations in Supplemental Materials.

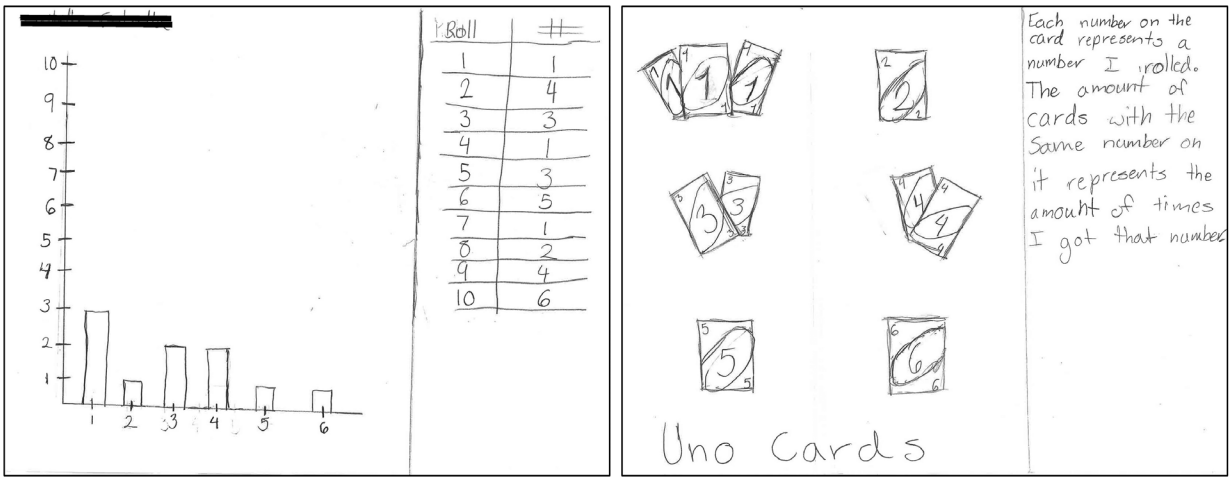
The impact of Dear Data

The Dear Data project has transformed how our students view and engage with data science. By combining creative interpretation and science, it demystifies data analysis while making it fun and personal. Students not only grasp data concepts but also take pride in their unique creations.

Utilizing modified Dear Data projects within our classrooms has benefited our students by teaching them how to visualize data in an engaging and innovative way. Through this project, they have learned to identify and extract meaningful data from their daily lives. Moreover, it has enhanced their ability to interpret and narrate the story behind the data in their science lessons, fostering a deeper and more nuanced understanding of data in everyday contexts.

The conversations around data show the growth of students' data literacy skills. When analyzing uniform color choice data, asking "why is everyone wearing mostly the same color uniform?", then discussing certain colors being ugly, a student asked,

FIGURE 3. Data table from dice rolls on left with data visualization and key on right. Student used UNO cards with card number representing the number rolled and quantity of cards the amount of times the number was rolled.



"I wonder if we would see the same pattern in other classrooms." When looking at food preferences, a student wondered if attendance would be higher on days when pizza was served because that data showed pizza as the favorite food. It turned out pizza day, Wednesdays, actually have the worst attendance.

As students have worked to compile the data, they have also worked to develop graphing skills, which allowed them to expand on their ability to choose an appropriate graph and set scales that effectively represent the data. Students have also learned how to collect and analyze data, a skill that has transferred to both science and math curriculum work. See link to A Quick Dear Data Activity in Supplemental Materials.

Future

As we continue implementing the Dear Data lessons, our goal is to deepen students' understanding of the stories behind the data. Early in the year, Dear Data helped us introduce the concept of seeing personal, everyday experiences as a source of meaningful data, which also helped build relationships with students at the beginning of the year. Students began by observing their lives, collecting information, and translating it into hand-drawn visualizations. This approach bridged the gap between the personal narratives hidden in the data all around them and the abstract graphs presented in textbooks. Moving forward, we aim to help students refine their ability to tell compelling stories through data, making connections between traditional representations and their own unique interpretations. While it's still too early in the school year to fully evaluate the impact of this strategy, we're encouraged by how students are engaging with personal data collection, data visualization, and graphing, and we look forward to seeing how these skills evolve over time.

This project demonstrates that teaching data literacy doesn't have to be overwhelming. With a bit of creativity and the right tools, we can inspire the next generation to approach data with confidence and curiosity. Whether you're a seasoned educator or new to teaching, Dear Data offers a refreshing and alternative way to make data literacy meaningful and memorable.

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SUPPLEMENTAL MATERIALS

Supplemental data for this article can be accessed at http://doi.org/10.1080/08872376.2025.2601365.

ONLINE RESOURCES

Big Bang Data: Dear Data [YouTube video]—*https://tinyurl.com/bb64jre2*
Building Data Literacy Skills—*https://tinyurl.com/yp57te4y*
Data Detectives: Inquiry and Visualization Lessons—*https://santacruz.arizona.edu/data-detectives-inquiry-and-visualization-lessons*
DataSpire—*https://www.dataspire.org*
Dear Data: The Project—*https://www.dear-data.com/theproject*
Get To Know You Data Visualization Activity—*https://tinyurl.com/4e6x54kp*

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