

Exploring Visual Representations of Sugar - BMCC/CUNY Research Lesson #2 - Summer 2015-Summer 2016

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Overarching Goals

We want students to **be problem-solvers** and to **feel like they have a voice in society**.

During this lesson, we want students to...

Be **inquisitive** about math/world connections and use math to navigate their world.

Be **generous** and compassionate and think about how to work with others.

Experience a sense of **joy** in learning and become teachers themselves.

Content Goal

Students will begin to compare the effectiveness of various types of displays in organizing the data for further analysis or in presenting the data clearly to an audience

Overview of the lesson study:

We started this lesson study project in June of 2015, expecting to spend about 8 weeks doing a lesson study and research lesson. Over the last year (!), we have made some course corrections, focusing eventually on visual representations of data, after reading broadly on statistics and probability. Visual representations ended up being a rich and complicated subject for a lesson study. This has been a rewarding process in that we have been introduced to subject matter we don't often teach comprehensively.

Our group has worked carefully to scaffold and sequence the activities in this lesson, so that students use background knowledge and hands-on experience to create their own visual representations in the final part of the lesson. We know that the lesson isn't perfect, but that's not really the goal and we are looking forward to seeing how students respond and learning from their engagement.

Activities:

- ❖ *Looking at class data on beverage consumption*
- ❖ *How much sugar? (ordering beverages)*
- ❖ *How much sugar is it? (NYC PSA Video)*
- ❖ *Comparing Visual Representations*
- ❖ *Students make visual representations*
- ❖ *Writing log and discussion*

<p style="text-align: center;">Steps/Questions in Activity</p> <p style="text-align: center;">Teachers' response to student reactions</p>	<p style="text-align: center;">Expected student responses</p> <p style="text-align: center;">Goals/Methods of Evaluation/Notes</p>
<p>Data Generation (30 min.)</p> <p>Materials: post-its, sheet of newsprint prepared with premade line plot, newsprint with possible titles (as backup)</p> <p>Purpose: Introduces sugar and visual representations as a tool for telling stories, provides data for students to work with and for us to refer to again later in the lesson</p> <p>Place two questions on the board:</p> <ul style="list-style-type: none"> ● <i>How many sodas do you drink per week?</i> ● <i>How many glasses of water do you drink per day?</i> <p>For each question, ask students to write their names and a numerical answer on a post-it. For example, "Maria 4" represents Maria and 4 glasses water.</p> <p>Ask: "What do you notice about our answers? What does it say about us as a class? Can you tell me why?"</p> <p>Ask: "Is this easy to read?"</p> <p>Tell the class: "One way we could make clearer sense of this data is by organizing it into a graph." Put premade line plot for water consumption on the wall and move post-its onto the graph.</p> <p>To model: put your name and a number representing the answer to the question on a post-it. Place it on the water consumption graph . Ask students to put their post-its onto the graph.</p> <div style="border: 1px dashed black; padding: 5px;"> <p>Does anything stand out to you now that the stickies are organized? What does this data say about us as a class?</p> <p>How many people drank ____ glasses of water? How do you know?</p> <p>How does organizing the data help to understand it visually?</p> <p>Mention parking lot (easel paper for questions and topics that will be addressed at a later time.)</p> </div>	<div style="border: 1px dashed black; padding: 5px;"> <p>Student data will be disorganized.</p> <p>One student volunteers and starts doing most of organization.</p> <p>Students put post-its in the wrong place/column.</p> <p>Students put post-its up sloppily, i.e. the post-its have gaps in between them and don't form a column.</p> </div> <p>What questions are most useful in helping students see the value of organizing data visually?</p> <p>How to introduce and limit discussion of average?</p> <p>How does this section build towards the overall goal of the lesson?</p>

Point out that all graphs--on the TASC, in newspapers and magazines, etc.--have titles.

Give each table 2-3 minutes to come up with a title.

Share out the titles. Which ones do we like? What makes a good title?

Offer a few other not good titles and ask students what they think:

- *Dying of Thirst*
- _____ *Drank* _____ *Glasses of Water*

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If there is not enough time to elicit titles from students:

- *Our Class Drinks Less Water Each Day Than Most Other Classes*
- *Dying of Thirst*
- _____ *Drank* _____ *Glasses of Water*
- *Glasses of Water Drunk Per Day by Students in the Class*

Give students 2-3 minutes to discuss their thoughts about the titles with a partner and choose the one that they think best fits the graph.

Say: "I would choose *Glasses of Water Drunk Per Day by Students in the Class*, because it is the one that most clearly describes the information we could expect to find on the graph."

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Agenda

Refer to agenda of activities on the board:

Looking at Class Data on Beverage Consumption

Which Has Sugar? (Ordering Beverages)

How Much Sugar Is It? (Video)

Comparing Visual Representations

Tell Your Story: Create Our Own Visual Representations

Put "Questions" newsprint up on the wall.

Order Beverage by Sugar Content (30 min.)

Materials: color prints of beverages, cut beforehand (one set for each student group), actual order of sugar content for beverages (prepared chain of photos), tape for board

Purpose: Generates interest, students want to know what the answer is, provides more data through nutritional facts

Introduce the activity by saying that we are going to look at different beverages and make predictions about how much sugar each one has. After we have had some time to think about it and put the beverages in order from least to most sugar, we will look at their actual sugar content.

Most to Least Sugar

1. Give out photos of beverages. Ask students, in groups, to put beverages in order by the amount of sugar per item.
2. When groups agree on an order, ask them to tape the photos together in a vertical chain, from most sugar to least sugar.
3. When all groups have finished, invite them to the board to tape their chains next to each other on the board.

Lead a discussion about similarities and differences that students notice in the beverage ordering.

What do you notice?

Where do you see agreement/disagreement/disparity?

Which has the most sugar?

Which as the least?

And on which beverages did people disagree the most?

Tape up the **actual correct beverage order** as a chain of photos. Label it Actual..

Ask: "What do you notice? Does anything surprise you?"

Short discussion: *We put these up in order of how much sugar they have. If we put them in order of health, would it be the same?*

Students work collaboratively to arrange the beverages.

Students give reasons for placement based on background knowledge.

Students consider the size of each container.

Students discuss the idea of "good sugar" versus "bad/added sugar," and it may factor into their order.

Students select a spokesperson for their group to discuss the beverage order they chose.

Students consider how sugar content correlates with "healthiness." For example, even though Naked Juice has a high sugar content, students might argue that it is the most healthy because it contains the most vitamins/nutrients.

Does the data seem relevant to the students?

How does this section build towards the overall goal of the lesson?

<p>Point out that there is not necessarily a right answer. Sugar can be measured easily. To measure healthiness, we have to consider lots of other factors.</p>	
<p>Video of NYC PSA (10 min.)</p> <p>Materials: video on projector (https://goo.gl/QCgbIJ)</p> <p>Purpose: Powerful, reinforces that video is another visual representation that uses stories, it's the same thing! (sugar and sugar), introduces teaspoons, grams, other forms of measurement, makes students look back at the beverages in front of them</p> <p>Show video about amount of sugar in a 20 oz. soda (NYC public service announcement):</p> <p><i>Would you like to see the video again?</i></p> <p><i>What do you think of this video?</i></p> <p><i>What facts do you remember from the video?</i> 16 packets of sugar in 20 oz. of soda; causes obesity, diabetes and heart disease.</p> <p><i>How many grams of sugar are in a sugar packet?</i> 4</p> <div style="border: 2px dashed black; padding: 5px;"> <p>One teaspoon of granulated sugar equals 4 grams of sugar. One sugar packet also contains 4 grams of sugar.</p> </div> <p>Quick math problem on the board: <i>Mountain Dew has 77 grams of sugar. How could I figure out how many sugar packets that would be?</i> (worksheet for homework could allow for more of this)</p> <div style="border: 2px dashed black; padding: 5px;"> <p>This is a Public Service Announcement made by New York City. Who is the audience? Why did NYC make it? Is there a bias?</p> </div> <p>Ask: What makes this ad (PSA) effective?</p>	<p>How does this section build towards the overall goal of the lesson?</p>

Comparing Visual Representations (45 min.)

Materials: visual representations handouts (pictograph, infographic, bar graph), handout with questions, visual representations on projector, “Questions” newsprint

Purpose: Comparing the effectiveness of different visual representations with the goal of identifying criteria for evaluation, prepares students to create their own representation, provides a model, discussion of audience/purpose, give some date they might use

Take a quick poll: *How much sugar do Americans consume? (Using any measure you choose)*

Pair/share, then group conversation.

How much is “a lot?”

How do you know?

What makes you think/say that?

What is your timeframe?

What do you buy that has lots of sugar?

Where does the most sugar come from?

Record student estimates on the board.

Say: “This question of sugar consumption is something that has been studied extensively. Now we’re going to look at some of that data represented visually.”

Put students into groups of 3 or 4.

Hand out three different visual representations.

Give students 3-5 minutes to look at the graphs.

Ask: In general, what messages are these visual representations trying to convey?

Give out Comparing Graphics handout

Some questions specific to each graph that teachers can ask as they circulate around the room:

a. Infographic - 130 Pounds of Sugar

- Explain the relationship between grams, teaspoons, cups, and pounds. What would 2 pounds be in cups? Teaspoons? Grams? How about the recommended daily allowance of sugar for men and women in grams? What about in a year?

Students will use background knowledge to interpret visual representations.

Students will have an emotional response to the information represented, which may interfere with looking at the facts represented.

Students will struggle with understanding graphs mathematically and need time to process the data represented.

Goals for student understanding:

Pictograph - Students discover the specific numbers represented by this pictograph. They understand that pictures represent numbers/data and that people use pictographs because pictures can be more powerful than numbers alone.

Infographic - Students see that the number of teaspoons matches the numeral for each quantity. Students use background knowledge to explain why American Heart Association created this graphic.

Bar graph - Students are able to read the amount of maximum recommended amount of sugar for men and women, compared with the actual amount Americans consume. Students recognize that the bar graph and the pictograph represent the same data.

Students discuss the effectiveness of the visual representations separately from the content of the visual representations.

Validate emotional response to the data, but focus on mathematical evidence in the visual representations. Help students with specificity, using evidence to think about actions outside of the classroom students may take as a result of looking at these graphs.

Does the data seem relevant to the students?

How does this section build towards the overall goal of the lesson?

- *How many teaspoons was consumed in 1822 in 5 days? What about in 2012?*
- *How has sugar consumption changed?*
- *What is 130 pounds?*

b. Bar Graph - Sugar: Too Much of a Sweet Thing

- *What does each bar represent?*
- *How is this graph similar to and different from Sugar Addiction?*

c. Pictograph - Sugar Addiction

- *Why did the author choose this title?*
- *What does each spoon represent? Why add pictures of spoons - why not just have the numbers?*
- *Why do you think the recommended daily teaspoons is different for men and women?*
- *(If they recognize that the pictograph and bar graph represent the same data) Which did you look at first? Which one did you do have to do more work to understand? Which is more powerful? Why?*

General questions teachers can ask as they circulate:

1. *What do you see? What do you notice?*
2. *Explain the graph.*
3. *What is the point of the graph?*
4. *Based on each graph, how much sugar does the average American consume?*

Report Outs

Ask: *What struck you?*

What do you like about each visual?

Which were the most compelling? Why were they interesting?

Compelling? Confusing?

What makes a good visual representation?

Record student responses on newsprint.

Let's talk about audience for a moment.

- *If you were a scientist, which one might be more effective?*
- *If you worked for the government?*

- If you wanted to convince someone in your family?

What mathematical data does the graph show?

How does the graph show how much (sugar, soda) is being measured? How is quantity being represented in this graph?

How does the graph handle increments?

What period of time does each visual representation use? (day, year, 10 year increments)

What is the benefit of using a visual representation vs. text?

What point does the author(s) want to make? Is it effective?

What are other possible graphic representations that could have been used? Why do you think the authors chose this one?

What math do you see?

pictograph	pictures represent numbers; each picture represents the same thing; has a strong visual impact (bottles and cans, in this case)
infographic	information displayed in a combination of numbers, words, pictures, and other sometimes other graphs
bar graph	data displayed in bars, for comparing (amounts of sugar in this case).

<p>Students Create Visual Representations (60 min.)</p> <p>Materials: newsprint, markers, tape, handout, nutritional facts for each beverage</p> <p>Students work in small groups to create their own visual representations.</p> <p>Think about all the work we did today:</p> <ol style="list-style-type: none"> Our class beverage consumption from class data and post-its graphs Ordering beverages Video Pictograph Infographic Bar graph <p>Give out one more resource - the Beverage Nutritional Fact sheet.</p> <p>With your group, look over the Beverage Nutritional Facts handout. Which data strikes you as significant? What patterns do you notice? Any surprises?</p> <p>Give out Tell Your Story handout.</p> <p>Gallery Walk</p> <p>Materials: Post-its, newsprint with questions</p> <p><i>What is one thing you really like about it?</i></p> <p><i>What is one question you have?</i></p> <p><i>How did it affect you? How did it make you feel?</i></p> <p><i>What is the message of the visual?</i></p> <p>Groups return to poster and read/discuss the feedback and post-its.</p>	<div style="border: 2px dashed black; padding: 10px;"> <p>Students might use a 1:1 scale for their pictograph or confuse scale while making a pictograph (1 can representing more/less sugar than reflected in the data, or inconsistent amounts)</p> <p>Students might struggle to tell a story, focusing most on creating a numbers-based visual.</p> <p>Students might create a bar graph of all of the line-up activity drinks based on sugar content.</p> <p>Students might create a pictograph for sugar content of two or more very sugary line-up beverages.</p> <p>Students might pick a few beverages they drink most and make a bar graph of sugar content.</p> <p>Students might repurpose the class post-it data to calculate how much soda they (members of the group) drink per week as how much sugar they drink per week.</p> <p>Students might make a bar graph or pictograph of recommended daily sugar intake compared to sugar content in the line-up beverages.</p> </div> <p>How much sugar are we really drinking when we have popular beverages? How can students represent this visually so that other people can understand how much sugar they are really consuming?</p> <p>How are students using the different tools introduced in previous steps of the lesson?</p> <p>How do students decide how to proceed? Start with story, graph or data?</p> <p>Is one student deciding in the group? How are decisions made?</p> <p>How does this section build towards the overall goal of the lesson?</p>

<p>Encourage all students to provide at least one feedback/question for each poster.</p> <p>Ensure that all posters have feedback and/or questions.</p> <p>Ask students to begin discussion of the activity and choose the poster that they found most effective and explain why.</p>	
<p>Wrap-Up (15 min.)</p> <p>Writing Log and Discussion</p> <p>Materials: Writing log handout</p> <p><i>What did we do today? What mathematics did I learn?</i></p> <p>Respond to feedback from the gallery walk - <i>What did it help you learn about visual representations?</i></p> <p><i>What should the title for today's class be?</i></p> <p>Reveal the title we chose for this lesson: <i>Using Visual Representations to Tell a Story with Data</i></p>	<p>Does this sequence of activities support our content goal?</p> <p>Are there parts of the sequence that didn't yield as much?</p>

Plan for the Board

The Title of Today's Class: Using Visual Representations to Tell a Story with Data

<p>Date</p> <p>Agenda</p> <p>How many ounces of soda do you drink per week?</p> <div data-bbox="110 596 440 831" style="border: 1px solid black; height: 100px; width: 100%;"></div> <p>Possible titles for water graph</p> <p>How many glasses of water do you drink per day?</p> <div data-bbox="110 1180 440 1503" style="border: 1px solid black; height: 150px; width: 100%; padding: 5px;"> <p>(organized into bar graph)</p> </div>	<p style="text-align: center;">beverage photo chains</p> <p style="text-align: center;">most sugar</p> <div data-bbox="467 449 513 1281" style="text-align: center;"> </div> <p style="text-align: center;">least sugar</p>	<p>How much soda do you think the average American drinks in a year?</p> <div data-bbox="824 434 1154 657" style="border: 1px solid black; height: 100px; width: 100%; padding: 5px;"> <p>Questions</p> </div> <p>Post visual representations and student comments</p> <p>pictograph - A Year of Soda for One Person</p> <p>infographic - Sugar, Too Much of a Sweet Thing</p> <p>bar graph - Average Pounds of Sugar Consumed Per Capita in the US (1822-2012)</p>	<p>Gallery Walk</p> <p>What is the message of the visual?</p> <p>What is one thing you really like about it?</p> <p>What is one question you have?</p> <p>How did it affect you? How did it make you feel?</p> <p>---</p> <p>Post student visual representations</p>
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Plan for Laying Out Handouts

Arrange handouts in activities chronologically, left to right, in stacks top to bottom, with first handouts on tops, spread so that all titles show.