

## Researcher Bio

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**Lesson Plan Title, Grade Level, and Keywords:** Water Quality Report Interpretation Exercise, 6-9<sup>th</sup> grade, Graphing and Interpreting Data, Math, Science

### **Brief Description of Research Interests:**

My research focuses on mitigating disinfection byproducts (DBPs), toxic substances that form when chlorine is added to our drinking water for disinfection. I am currently investigating the biodegradability of various DBPs through biological filtration (biofiltration), which consists of a traditional filter occupied by a biofilm that degrades various contaminants in the water as it passes through the filter. The significance of this research is related to public health, as some DBPs are known to be carcinogenic and otherwise toxic to humans. I use gas chromatography and fluorescence spectroscopy to evaluate the performance of the biofilters in degrading various compounds. In future work, I will be working with the Birmingham Water Works utility board to apply this research in a pilot-scale plant.

### Water Quality Report Interpretation Exercise (6<sup>th</sup>)

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Introduction/Abstract to Lesson Plan (max. 100 Words) Include aspects of the lesson that are unique and innovative.	The lesson introduces students to drinking water treatment and disinfection byproducts. They will use annual water quality reports to gather, plot, and interpret real-world scientific data. This lesson correlates to the research on the mitigation of disinfection byproducts in our collegiate research lab and the broader implications for drinking water treatment and public health.
List of Standards Addressed (This should be list of all full standards addressed by the lesson.)	<p style="text-align: center;"><b>Alabama Curriculum Guide: Math</b></p> <p>MATH.6.23 Calculate, interpret, and compare measures of center (mean, median, mode) and variability (range and interquartile range) in real-world data sets.</p> <p>MATH.6.23.a. Determine which measure of center best represents a real-world data set.</p> <p>MATH.6.23.b. Interpret the measures of center and variability in the context of a problem.</p> <p>MATH.6.24 Represent numerical data graphically, using dot plots, line plots, histograms, stem and leaf plots, and box plots.</p> <p>MATH.8.18 Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities, describing patterns in terms of positive, negative, or no association, linear and non-linear association, clustering, and outliers.</p>
Learning Objectives using Measurable Verbs (what students will be able to do)	<ul style="list-style-type: none"> <li>• At the end of the lesson, the students will be able to find the mean, median, and mode of a data set.</li> <li>• At the end of this lesson, the students will be able to plot data over time and interpret trends in the data.</li> </ul>
Appropriate Grade Levels	6 <sup>th</sup> or 8 <sup>th</sup> grade based on current state standards, but could be adapted to 6-9 <sup>th</sup> grades
Group Size/# of students activities are designed for	Individual work or groups of up to 4 students
Setting (e.g. indoors, outdoors, lab, etc.)	Indoors
Approximate Time of Lesson (Break down into 20-50 minute periods)	15 minutes for lesson introduction, 20 minutes altogether to complete the assignment, 10 minutes for class discussion and personal evaluation

Resources Needed for Students (e.g. scissors, paper, pencils, glue, etc.)	Printed reports (1 per year per group) Printed worksheets (see attached) Calculator Pencil
Resources Needed for Educators (e.g. blackboard, Powerpoint capabilities, etc.)	Internet access PowerPoint capabilities Printer
Apps/Websites Needed	<a href="https://www.tuscaloosa.com/city-services/water/water-treatment">https://www.tuscaloosa.com/city-services/water/water-treatment</a> This website has links to water quality reports from 2011-2022
Lesson Activity (step by step description of activity)	<p>Background</p> <ul style="list-style-type: none"> <li>• Water from our tap does not just come from the river/lake, it has to be treated first to be safe for us to drink.</li> <li>• Disinfection is an important part of drinking water treatment because it protects us from waterborne disease.</li> <li>• When we add chlorine for disinfection, it can react with other compounds in the water to form disinfection byproducts (DBPs).</li> <li>• Some DBPs are harmful to human health, so they are regulated by the Environmental Protection Agency (EPA).</li> <li>• The city is required to report information related to the quality of our water once a year.</li> </ul>
	<p>Introduction</p> <ul style="list-style-type: none"> <li>• Lecture on overview of drinking water treatment and disinfection byproducts (see PowerPoint provided).</li> <li>• Pass out printed quality reports and graph paper</li> <li>• Alternatively, have students pull up website and spreadsheet software if they have access to computers.</li> </ul>
	<p>Step by Step Activity</p> <ol style="list-style-type: none"> <li>1. Students examine water quality reports and find the 'Average Level in the Distribution System' values for Haloacetic Acids and Trihalomethanes (the two regulated types of DBPs).</li> <li>2. Plot the values against the year for both HAAs and THMs. This can be on the same graph or on separate graphs, as long as the trends are differentiable.</li> <li>3. Calculate mean, median, and mode for the values over the span of 11 years.</li> <li>4. Plot the data in a histogram, box plot, and/or distribution curve</li> <li>5. Observe any trends seen.</li> </ol>
	<p>Reflection/Assessment</p> <ul style="list-style-type: none"> <li>• Have students observe any trends in the data. Is it increasing? Decreasing? Staying the same?</li> <li>• Have students use a box plot and/or a distribution curve to identify any outliers in the dataset.</li> <li>• Each student or group should write a 4-6 sentence paragraph summarizing their findings.</li> </ul>
Final Product/Assessment (e.g. quiz, presentation, essay, etc.)	The students will turn in all generated graphs, mean, median, and mode values, and their written interpretation of the data in a worksheet at the end of class.