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Week 8: 6/29/20-7/5/20
Methods of STEM Education

Authentic Data Integration Assignment

a) **Data Source: NYC Department of Health - Environment & Health Data Portal**

Data sets:
1. [Race and Ethnicity - Percent Non-White , 2012-16, Neighborhood (NTA)](#)

2. [Children under 5 years old in Poverty - Percent , 2013-17, Neighborhood (NTA)](#)

3. [Neighborhood Air Quality: Fine Particulate Matter (PM2.5) - Mean (mcg per cubic meter), Annual Average 2018, Neighborhood (Community District)](#)

4. [Asthma Emergency Department Visits - Children ages 5 to 17 - Estimated Annual Rate (per 10,000 residents), 2016, Neighborhood (UHF 42)](#)

5. [Total count of COVID-19 cases based on patient address by ZIP code (as of May 17, 2020)](#)

b) Lesson Enhancement: Describe how the data enhances a topic that you currently teach or plan to teach. Include a 1 paragraph statement about your personal feelings regarding using data.

In the past, I have taught a unit on Environmental Justice primarily focused on a case study of the South Bronx. Through the case study, we analyze data pertaining to asthma rates, air pollution (specifically particulate matter 2.5), and poverty in the South Bronx and the different social factors that have led to this public health crisis. In light of the COVID-19 pandemic, I would like to teach a future unit about Environmental Justice that expands its focus to include all of NYC and integrates race/ethnicity and COVID-19 data in addition to existing data on asthma rates, air pollution, and poverty. The Environmental Justice unit would focus on the tragic phenomenon of the disproportionate impacts of the COVID-19 pandemic that we've been living in NYC and the connections between the environment, socioeconomic factors, and public health outcomes.

After learning about the fundamentals of Environmental Justice, students often struggle to brainstorm Environmental Justice issues in their own neighborhoods, they most frequently mention cigarette smoking and litter as the most pressing issues. In order to prepare them to analyze these DOH data sets, I would have my students collaboratively practice analyzing other data sets available on the DOH website related to transportation, parks and public space, and climate change vulnerability.

This data would enhance my teaching of Environmental Justice because my students are more likely to really engage in the unit if they 'see' themselves and their experiences in the data. My school primarily serves students of color (over 90%) who qualify for free or reduced lunch (~70%) and many of their families have been directly impacted by the COVID-19 pandemic.

By expanding the focus of my unit to include all of NYC, I could also give students the freedom to choose smaller portions of the data sets on which to focus their analyses (for example, their own neighborhood, borough, zip code, etc.). Providing students with multiple data sets and challenging them to visualize the data in different ways - through maps, graphs, charts, etc. - would create many new learning opportunities for my students. After some practice and collaboration with their classmates, they would have the skills and confidence to undertake their own project focused on a subset of the data of their choice.

Focusing our classroom conversations, discussions, and writing prompts around the data transforms student thinking and pushes them to make observations, inferences, and connections to the scientific topics we've studied in class. Using data challenges students to move past their opinions and preconceived notions in discussions and forces students to cite specific evidence from the data sets to support their ideas. Having data to observe and cite puts all students on an equal playing field in discussions and grounds the conversations in facts.

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c) Interdisciplinary context: How can the data be used to create interdisciplinary lessons, discussions or activities in your classroom. How can you connect to multiple content areas?

The data sets from the NYC DOH could be used to create an interdisciplinary project between the science, math, and computer science classes at my school (9th- and/or 10th-grade classes) and would address three NGSS Crosscutting Concepts: (1) Patterns, (2) Cause and Effect, and (3) Scale, Proportion, and Quantity. Additionally, the skills students would practice and employ in their final interdisciplinary STEM project would incorporate three NGSS Scientific and Engineering Practices: 4. Analyzing and interpreting data, 5. Using mathematics and computational thinking, and 7. Engaging in argument from evidence (NRC, 2012).

Science component: In Biology/Living Environment (8th or 9th grade), students learn about body systems including the respiratory system as well as examples of human impacts on ecosystems like air pollution. In Earth Science (9th or 10th grade) we learn about specific types of air pollution and their impacts on different environments as they relate to acid rain and climate change. These Disciplinary Core Ideas would provide students with the content knowledge needed in order to make observations, inferences, and connections using the data sets (SEP 4. Analyzing and interpreting data).

Math component: In Algebra, students learn how to create informative graphs with appropriate axes and scales and calculate averages. These skills could be leveraged to create informative graphs showing how COVID-19 impacted different demographics for the students' chosen area of NYC. Additionally, students could plot multiple variables on the same graph to show possible relationships (cause & effect) between the different data sets (SEP 4. Analyzing and interpreting data).

Computer Science component: In our 9th- and 10th-grade Computer Science classes, students learn to use a variety of programs and applications to visualize data (Google Sheets, HTML, or

Javascript for example) and identify patterns across different scales. For struggling students, this could take the form of a website where they embed images and graphs. Students could take screenshots of the maps created by the DOH and cite them in their website while making their own graphs using their algebra skills. More advanced students could write basic computer programs that will analyze data sets and return specific values based on their inputs (SEP 5. Using mathematics and computational thinking). They could write their own program that would help their analysis. Students would use their science knowledge to explain the significance of the data visualizations they create.

Social Justice component: As a final piece to the project, students could use the knowledge and artifacts they create to communicate what they've learned to a larger audience and advocate for change. This could take the form of a letter directed to a relevant person in a position of power or a specific advocacy page on a website that references their data visualizations and analyses (SEP 7. Engaging in argument from evidence).

References:

National Research Council. (2012). A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas. Committee on a Conceptual Framework for New K-12 Science Education Standards. Board on Science Education, Division of Behavioral and Social Sciences and Education. Washington, DC: The National Academies Press.