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Quantifying Solutions to Reduce Our Food's Environmental Impact

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Introduction

"Any fool can know; the point is to understand." Albert Einstein, perhaps one of the most celebrated problem solvers, knew the importance of understanding, and I believe my students yearn for that. Adolescents are known for their curiosity and strong opinions; however, we often miss the opportunity to tap into these natural resources in the classroom for fear of losing control of classroom management, deviating from a rigid curriculum, or limitations in our own depth of knowledge on a topic outside our expertise. When I read about this summer's seminar on energy and the environment, I saw an opportunity to build my own content knowledge around a topic I know my students care about. My 8th grade math students care passionately about the environment and how they can help save the earth. I will bring my mathematics background into this area to make connections that will be meaningful and important to students to understand how math is used in every discipline, and can be an essential tool to solving real problems they care about.

The K-12 mathematics curriculum centers on algebraic thinking and problem solving. While for mathematicians algebra is the exciting core of our subject, students in middle and high school often struggle to see the relevance of it in their daily lives. Their lack of enthusiasm became abundantly clear to me when I was teaching students about quadratic relationships.

We dutifully explored various representations of quadratics, word problems, and even incorporated algebra tiles as manipulatives to help my visual learners conceptualize this new content. My students learned quadratics and were able to fluently apply their knowledge in any situation I challenged them to investigate. It was the question posed to me that proved most challenging. "Ms. Agostinelli, no one uses quadratics in their daily life. My parents don't even know what it means. Why are we bothering to learn it?" At that moment, it occurred to me that my students weren't viewing math as a discipline, but rather as a distinct set of skills, most of which served no purpose in their daily lives.

I could have come back with the true, albeit somewhat contrived, facts: the more math you know, the further you typically go in higher education; careers that use complex math pay high salaries; being a numerate citizen will help you avoid being cheated. However, they have heard all of that before. I realized that they didn't value the core philosophy of my teaching, that being able to think and solve problems is all you'll ever need, because I had not made that method the focus. I realized we needed to shift from the focus we had on the content itself and broaden our scope to the larger and more important process of thinking that

mathematics forces its students to develop.

I also want to build my students' capacity as critical thinkers who consume and create media, which will lead naturally into our culminating project of student-created public service announcements with accompanying infographics that quantify solutions to the problems they investigate. This unit will enhance their abilities in reading and understanding nonfiction text with embedded mathematics, a skill that will be a large focus across our middle school teams next year. Students will articulate research-based arguments supported by mathematical evidence, speak to persuade an audience to make practical changes in their lives to aid in solving the problem they investigate, and listen critically to others' ideas and suggestions. Additionally, my central purpose of helping students use math in a real world context that matters to them will fuel our studies. All of these skills align with the Common Core State Standards and challenges students to think using an interdisciplinary lens that connects and strengthens their abilities across content areas.

Rationale for Unit

This unit will be the first of the eighth grade algebra year for students I taught last year in seventh grade pre-algebra. Their understanding of linear algebra will be a solid foundation from which to build their knowledge of functions, statistics, and how data is communicated along with why being critical consumers of data is a vital life skill. To address my students' dissatisfaction with the relevance of math to their lives, I will focus heavily on the problem-solving process and how it can be applied across disciplines to solve problems, and then how math can be used to strengthen those solutions by quantifying impact and communicating clearly with numerical evidence. This unit plays directly into the curiosity of my students about the world we live in, the problems they will inherit, and the challenges they must learn to address. While we will all focus on the large topic of food and the environment, students will break off into more focused interest groups to pinpoint problems that relate directly to their diets and quantify solutions that will be meaningful in their own lives and the lives of their families.

Beginning the school year with this unit will enable me to set the foundation for the problem-solving environment of inquiry that I want my classroom to be for students. Following Polya's "How to Solve It" framework, students will learn how mathematicians and scientists approach problems to formulate solutions. They will see more of the mathematical thinking required to implement change and make interdisciplinary connections to see how it can be applied to solve any problem. Polya's four-step process includes: understanding the problem, devising a plan, carrying out the plan, and looking back. By explicitly teaching each of these steps using data students gather from their food logs, we will establish common language and strategies for following the process in a repeatable way to attack problems throughout the year.

In addition to strategic thinking, students will focus on questioning problems as well as information they encounter during research. While students are excellent at knowing to question data, they often struggle with knowing what to ask. I do not think there is a quick fix for this, as it is something even the most seasoned problem solvers must constantly struggle to do. However, the more experiences students have that require critical analysis and deep thinking to solve, especially around problems they choose, the better they will get at it. Along the way, we will establish shared beliefs and behaviors to foster an environment of questioning, which I am basing largely on work by Francis Hunkins and the book *Quality Questioning* (Walsh, 2005).

As Francis Hunkins noted, "We are shifting from viewing questions as devices by which one evaluates the specifics of learning to conceptualizing questions as a means of actively processing, thinking about, and using information productively. Many educators are weaning students from believing that questions are phrased to attain certain answers and are helping them to accept questions as key vehicles that elicit awareness of the diversity, complexity, and richness of knowledge. More educators are assisting students in comprehending that questions are linguistic goals that enable thinking and production of knowledge" (1995). The kinds of questions Hunkins is talking about are vastly different from the typical classroom questions that assess whether students are prepared, or if they understand what we have taught them; these new questions will lead students to better understandings of the information and its relevance to their lives.

> "Creating a Culture of Inquiry is about establishing and nurturing norms that promote powerful and productive conversations. Leaders attend to this element when they talk with members of their school communities about the value of inquiry, model inquiry, and build a climate of trust and mutual respect" (Walsh, 2005).

This is no small task. The barriers that exist to students' comfort with questioning are especially deep in math, as the subject is often presented in black and white; you either understand or you don't. These barriers are also particularly pervasive during the formative and often frightening middle school years when students are extremely self-aware and try their best to avoid scrutiny, especially in academics. However, I believe that middle school is also an amazingly opportune time to have students investigate topics they care about, as their passion against injustice is strong and they are always willing to argue. By focusing on a problem they choose that stemmed from their own diets, asking questions will be more important and personal to them, which I think will make it a more natural process.

Context

I teach middle school mathematics at a Chicago Public School where the population consists of 680 Chinese and African American students from pre-kindergarten through eighth grades. Over 95% of our students receive free or reduced lunch, and most eat 2-3 meals per day at school. This makes food an issue very much tied to their school experiences, and it is also an important cultural component of many of their lives. Approximately 7% of our student population has IEPs to accommodate learning disabilities, and 75% are English Language Learners. The dominant language of origin is Cantonese. I designed this unit for my 8th grade general mathematics course, but it has the flexibility to be tailored to shift the main focus to a science or language arts course as well.

Students often struggle in middle school mathematics because the focus on computation in the younger grades overrides the emphasis on thinking, reasoning, and explaining that is the cornerstone of my curriculum. Often, students have never been given a problem to solve that they did not already know how to do; traditional mathematics teaching provides a sample problem, gives students the algorithm, and provides practice problems that replicate the process they were shown. This unit is purposely designed to force students to find and apply the mathematics where it is needed and fits into their quest to come up with solutions to their food problems.

Objectives

This unit is designed around the eighth grade math Common Core standards involving statistics and functions. By examining data through various lenses, students will become critical consumers of information and see the flexibility of mathematics to be used, in both honest and purposely misleading ways, as evidence to sway audiences who are expected to take the message at face value. They will also learn multiple ways to represent data for different purposes for their own presentations. Students have a solid foundation in understanding and representing linear relationships, so we will learn about nonlinear functions and determine when to use different representations of data, including graphs, tables, equations, and written descriptions.

Writing standards are also addressed as students research and develop their solutions to persuade their audiences to act on their findings. This will connect to the different representations of data, in that students will use mathematical evidence to persuade; they will need to represent data accurately, but in a convincing way. This will provide further opportunity for questioning as students consider the data from multiple perspectives and try to gauge reactions from broad audiences.

The Standards for Mathematical Practice will be a mainstay throughout every piece of the unit, and will connect the disciplines of math, science, research and writing to help students see the importance of critical thinking and questioning when consuming, synthesizing, and communicating data to solve problems. All eight practices will be used throughout the unit, and I will be explicitly teaching and bringing out examples of students employing them to help students build awareness of their metacognition.

Strategies

Guided Math Workshop Model

I will have students for 90 minute periods twice a week when we will employ a workshop model to allow students time and space to work on their research and production while we build common math content knowledge. Each class period will begin with a whole-class mini-lesson to build math content knowledge of functions and statistics. Students will then rotate through stations, including reading, book club discussions, research, writing, and math (to reinforce content skills we are learning), and meeting with me to synthesize the data they are finding and to fine-tune the mathematics of their arguments. We will end each day with a whole-group summary that will highlight any discoveries students made that connected their projects to our mini-lesson content, answer questions, and set up a plan for their day off from math class as well as our next session.

Jigsaw Reading

I will launch the unit by modeling the strategy of jigsaw reading with students using an article from Scientific American that gives an overview of environmental issues related to food. This strategy involves dividing a reading into sections and assigning 4-6 students to each section which they will read to become experts. The experts meet with the others in their fields to come up with a cohesive summary of what they read that will be communicated consistently to the others who did not read that section. Then, the students go back to their

original groups where they hear from experts from all the sections. This approach allows students to take on manageable chunks of nonfiction text that is often daunting to them, it holds them accountable for what they read, and it promotes discussion. I hope that students will employ this strategy in their book clubs at times they deem it appropriate and helpful.

Book Clubs

Students will form book clubs based on one of five interests under the umbrella of food and the environment: waste, bottled water, school lunches, where food comes from, and fast food. I have selected anchor texts for students to use in book clubs where they will schedule reading and discussions for three weeks to build common knowledge on their topics, and to spark discussion and debate that will ultimately enhance their solutions. I learned firsthand at the Yale National Initiative the importance of common readings to give purpose and direction to collaboration while we branched off into our specific topics from the broader topics of our seminars. Students will have this same model to follow as they navigate nonfiction text and refine their foci.

Graphic Organizers

I will provide students will graphic organizers to help them throughout the process of researching, writing, and communicating their topics. A basic web will be used for brainstorming, with their problem in the center and questions coming out in different directions. I have developed a table that helps them refine those questions and include information gathered as well as another point of view to use as they clarify their arguments. Next, students will use a Making Connections organizer to help them synthesize their research into their own schemas. Finally, they will organize problems and solutions they identify from their research in a T-chart to see which they want to pursue as their final product. For the public service announcement, students will plan using a storyboard to chunk information.

Differentiation

This unit is structured to allow for many natural differentiation opportunities. Students working together in small interest groups will promote the sharing of strengths within those cohorts. The workshop model will allow me to provide assistance as needed, and to adjust the depth of that assistance to meet the needs of individual students. In addition, there are no strict deadlines for students to meet along the way, offering the opportunity for me to plan with students benchmarks they will need to meet in order to complete the work.

Assessment

Formative Assessment

I have selected benchmark MARS (Math Assessment Resource Service) tasks to gauge students' understanding of key concepts as we progress through the unit. These tasks include the skills of analyzing claims, converting metric units to measure equivalent portions, efficient packaging of products, packaging products with equivalent volumes into different shaped containers, reading food data on a scatter plot, and analyzing averages to determine whether or not they are accurate measures of data in specific cases.

Each task is scaffolded to guide students from very basic application of the skills to more advanced reasoning. Each also has an accompanying analytical rubric that breaks the task into pieces of demonstrating mastery; students will understand exactly which pieces they understand and which need further clarification. The tasks incorporate reasoning into students' responses, which will allow me to pinpoint misconceptions.

Other forms of formative, informal assessment will include exit slips for students to reflect on the process and content and to express confusion, my observations in small group time, and conferences with students.

Summative Assessment

To measure how well students have met the objectives of this unit, they will create multimedia public service announcements to communicate their problems, data, and proposed solutions to the topics they study. I have included a rubric for this component in the appendix. Students will also design infographics to convey the same information in their PSAs, only in print form that will be distributed to their target audiences. Infographics are visual ways to represent data that have something to do with the topic of the data. Creating these will give students practice in communicating concisely and representing data in a visual format. They will have to justify their decisions for what they include in each representation using a self-assessment tool.

Background

Food and the environment are universal topics that affect everyone in various ways. As Pimental explained,

> "Basic to man's survival are adequate food, water, and shelter; maintenance of health and personal security are equally important. Close interrelated with these life-essentials is an adequate energy supply, for energy in some form or other is used in attaining food, water, shelter, security, and protecting man from parasites and predators," (Pimental, 1979).

Pimental had foresight that has expanded perhaps beyond what he expected; the interconnectedness of food, energy, and health is pervasive and extensive. From the early stages of hunter-gatherers, when the energy was primarily dependent upon manpower to get from the wild to consumption, the amount of processing of food from its natural state and the resulting impact on the environment has grown exponentially.

We take for granted how food gets from its origins to our mouths, and also where the waste it produces goes after we enjoy it. My students are passionate about finding ways they and our school community can help the environment. When they complete their personal food audits, I anticipate that they will be drawn to at least one of the five areas I've planned for: waste, bottled water, school lunches, where food comes from and what to eat, and fast food, which are the areas I have researched.

Waste

Students will read *Waste: Uncovering the Global Food Scandal* by Tristram Stuart as the anchor text for this topic. One of the problems with diets consisting mainly of processed food is the packaging. Students' school breakfasts and lunches contain items that are almost entirely individually packaged. The spork, straw, and napkin also come in plastic wrapping, and everything is served on a Styrofoam tray. Of all of this, only the trays are recycled.

In addition to packaging, students waste the food itself in astounding quantities. Every student is required to take one of everything offered, whether they want it or plan to eat it or not, which is usually 3-4 food items and a carton of milk. Many days, students will throw out everything on their trays except the milk. This accounts for the food they consume in school, but nearly all the food consumed outside of school is similarly packaged. A large population of our families own or work at restaurants in the community, so students are often seen with takeout containers and disposable soda bottles. Because this issue is so prevalent in our school, students will have immediate data to collect and analyze to make recommendations to reduce waste from packaging. I hope that some will also look to why the food is being thrown away through surveys to push for higher quality, fresh foods to be served.

Bottled Water

Students will read *Bottled and Sold: The Story Behind Our Obsession with Bottled Water* by Peter H. Gleick as the anchor text for this topic. There has been an attack on tap water that has grown in the past two decades, partly explicit through attack ads and campaigns from bottled water companies, and partly implicit through the reduction of availability of public drinking fountains. Consumers are bombarded with disposable plastic bottles of water everywhere from sporting events to schools to parks. The bottlers prey on fears to sell a product that is available from the tap for free or very little cost.

Aside from the cost, the quality regulations for bottled water are harder to enforce, and it is left to states to follow through. While, by and large, bottled water has proven not to be harmful, you won't find what you don't look for. We simply do not have a comprehensive assessment of actual bottled water quality. If we did, it may show to be equally safe or safer than tap water, but given the amount of money consumers pay for it, we should expect its benefits to be proven.

Finally, the amount of waste produced from disposable bottled water is unnecessary. The demand is huge, but the rate of recycling is extremely low, having remained around 27% since 1990. In part, this is due to the fact that only about 1 in 5 bottles are made with PET that can be recycled. The rest wind up mostly in landfills. One argument is that this is just a product we do not need, so why impact the environment negatively for a luxury?

Students will investigate the tradeoffs of tap versus bottled water in our community to determine whether or not there is any merit to the fears people put into drinking from the tap. Is there a filtration system that would alleviate these fears and contribute to increased use of fountains? Why have efforts to replace disposable bottles with reusable bottles failed at our school? Is the convenience factor something we can match by altering our schedules and routines to accommodate fountain use?

School Lunches

Students will read *Fed Up with Lunch* by Sarah Wu as the anchor text for this topic. The National School Lunch program feeds over 31 million kids everyday. With one in four school-age children overweight or obese, this is cause for alarm. For the first time in over two centuries, kids have shorter life expectancies than their parents, and the cost of treating weight-related illnesses is enormous.

What is causing this epidemic? I watch kids throw out the food on their lunch trays everyday, opting instead to run to the corner store after school to buy chips, soda, and candy to address the hunger they feel by the end of the school day. So are school lunches really the problem? My students think so. The food is simply unappetizing; so although it meets FDA guidelines for being balanced, they are not eating it, or are eating only unhealthy portions. Would providing fresh, nutritious food encourage students to eat their lunches and stray

from the junk food they inhale after school to make up for missing meals?

Where Food Comes from and What to Eat

Students will read the young readers edition of *The Omnivore's Dilemma: The Secrets Behind What You Eat* by Michael Pollan as the anchor text for this topic. Students are bombarded with advertising that sells food based on its taste, look, and popularity, but few of them know what they are really eating or where it came from.

In the past, people knew where their food came from because they hunted and gathered it. Food was often a family affair; children learned recipes and food history from their parents and grandparents and ate what had been eaten in their families for generations. Today, most of our food is industrial and largely corn-based, and only about 20% of the money spent on processed food goes to the farmer. The other 80% is divided among labor, packaging, transportation, energy, profits, advertising, depreciation, rent, interest, repairs, business taxes, and other costs that add up to the marketing bill. As George Naylor said, "There's money to be made in food, unless you're trying to grow it."

Pollan explores three parts of a solution to the problem of what to eat. First, he suggests eating real food that has not been significantly altered from its natural state. Next, he explains that the perimeter of the grocery store is where to shop to avoid processed food and focus on fresh foods. Finally, he advocates for eating real meals by cooking your own food, taking the time to sit and eat slowly, and making eating a social event with family on a consistent basis.

Fast Food

Students will read *Chew on This* by Eric Schlosser as the anchor text for this topic. Branded as "everything you don't want to know about fast food," this book reveals many facts that we never even think to question, and many we do not want to think about because the reality is not something anyone would willingly engage in. The main focus of the book is McDonald's food practices. This is especially relevant to my students because it is the only easily accessible fast food chain from our school and students love to eat there, not thinking at all about where the food comes from.

In addition, this book forces students to look at the marketing strategies that are geared directly at them and face the reality that they are manipulated into purchasing and eating these foods for reasons that are not entirely honest and certainly are not healthy. By becoming more informed consumers themselves, students will be able to devise strategies to help their peers make better decisions about what they eat and which companies they patronize.

I hope that students might delve into the research that is available on the relationship between median income and distance to fast food restaurants versus fresh food grocery stores, which will require additional research outside this book.

Classroom Activities

Day 1-Pre-Assessment and Brainstorming with K-W-L

Students will have 10 minutes to think and write independently about the Giantburgers task, which assesses their ability to reason with large numbers, as well as to evaluate the validity of mathematical claims. The thrust of this task is to encourage students to be critical consumers of information to better see the connection of math to their everyday lives.

Think-Pair-Share is a strategy that encourages students to take time to think before answering a question, and it also holds them accountable knowing that they must share their thinking with, at a minimum, a partner. Students, especially in the middle grades, are often hesitant to share their thinking to open-ended questions, which leads to a few students engaging with the teacher while the others are able to zone out. Learning is a participatory sport, so it is essential in a unit like this for all students to be engaged in order for them to benefit from the content and skills being developed throughout the unit. As Harvey (1999) points out, other benefits of this strategy include:

- Providing "think time" increases quality of student responses.
- Students become actively involved in thinking about the concepts presented in the lesson.
- Research tells us that we need time to mentally "chew over" new ideas in order to store them in memory. When teachers present too much information all at once, much of that information is lost. If we give students time to "think-pair-share" throughout the lesson, more of the critical information is retained.
- When students talk over new ideas, they are forced to make sense of those new ideas in terms of their prior knowledge. Their misunderstandings about the topic are often revealed (and resolved) during this discussion stage.
- Students are more willing to participate since they don't feel the peer pressure involved in responding in front of the whole class.

After thinking and writing about their own ideas, students will pair with a peer at their tables to discuss what they wrote in an effort to clarify their thinking and prepare to share whole class. Before pairs begin, we will set the focus for their five-minute discussions on reasoning, or supporting their claims with evidence and thinking. As a whole group, after pairs have had time to discuss, we will chart thinking about the task with an emphasis on how students made their decisions based on the information provided. I will lead students to consider what information would have been useful to know in order to make a more informed decision.

From here, I will introduce our unit of study on energy and food by giving students an overview of the five areas of food they will choose from: waste, bottled water, school lunch, where food comes from and what to eat, fast food. The K-W-L strategy will be used for this segment of the lesson. We will brainstorm what we know and want to know about each of these five areas, leaving the learned column blank for students to add to as they discover new information during their research.

Day 2- Analyzing What We Eat through Data Collection

Students will be introduced to the Personal Food Audit template where they will record what they eat for a week and identify problems they see in their own diets that fall into one of the five categories we are studying.

I will model this process with a day from my diet, showing students how to use the template as well as questions I asked myself to determine areas I could make changes in my diet. Students will use a second day's sample from my diet to analyze in groups. We will share and discuss, as well as answer any questions students have about the process. We will chart a list of questions to ask when analyzing data.

Students will then work on analyzing nutrition labels. Groups will be given different labels to summarize. Some will have single serving products, while others will contain multiple servings. Groups will share their summaries while displaying the labels and as a class we will discuss misconceptions that would be common if we didn't read labels with a critical eye.

Days 3-30* Book Clubs, Skill Building, and PSA Development

(*We have shifted to double periods, so time may vary)

The structure of students' book clubs will stem from their interests and abilities; after forming groups based on the problems they are investigating, they will develop a schedule for reading and discussion that incorporates the shared book they read along with their personal research and articles I share with them via our class portal. Students will have the autonomy to use their books as resources or as cover-to-cover reads as they see fit.

Building an annotated bibliography will be one of our skill focus points during book clubs, and mini-lessons will be delivered at the start of class periods to help students navigate this new world. I will employ the use of www.bibme.org, a free web-based tool for students to keep track of their sources. Once they have their list of sources, we will work on brief annotations to describe how they used each source.

Math skills will span broadly across the content strands of ratio and proportion, data analysis, and expressions and equations. Process skills will include communicating mathematical data for a variety of reasons, problem solving, reasoning and proof, and representing data. I will deliver daily mini-lessons on these topics, and formative assessments will be administered throughout the unit. The use of MARS tasks will be integral, as their analytical rubrics assess the skill at various levels of understanding. I have listed the tasks that will be used in the Appendix.

Throughout the research period, students will meet with me individually to ask questions, check in and allow time for individualized instruction in areas of need. Data from the formative assessments, as well as student requests, will be used to determine the order and frequency of these meetings. The goal of this time is for students to think more specifically about their topic of research rather than the general skills involved. There will be a huge emphasis on connecting the mathematics to their real-world issues, as this is an area of deficit in our curriculum; students have trouble seeing the connections between math and the world around them.

As students gather information, it will be important for them to organize it with their final product of a Public Service announcement in mind. I have created a storyboard template for them to use to help with the flow of their presentation. They will consider questions such as: Who is my audience? How should my audience's attention be grabbed? Which information is most important and easily understood by the general public? What action will my audience take as a result of this information?

Our technology teacher will help students with the technical aspects of creating their PSAs. We plan to use Windows Movie Maker along with iMovie to develop these videos, and students have varying levels of experience and comfort with each. One of the most valuable resources students will receive is time and space

to work; they need to have a balance of receiving and processing the plethora of information coming at them.

During the last week of the project, students will spend their entire time on production of their PSAs and infographics. Daily sharing of progress will take place, along with peer critique. As students become experts on different aspects of the process, they will deliver the mini-lessons that start class to share that knowledge with their classmates. Both the technology coordinator and I will be assisting students, and their work will be documented using a flip camera. I will post daily blog posts about their progress.

Implementing Common Core State Standards

Mathematics Content Standards

8.F.1: Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output.

8.F.5: Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g. where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

8.SP.1: Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Mathematical Practice Standards

Standard 1: Make sense of problems and persevere in solving them.

Standard 3: Construct viable arguments and critique the reasoning of others.

Standard 4: Model with mathematics.

Standard 6: Attend to precision.

Standard 8: Look for and express regularity in repeated reasoning.

ELA Standards (Writing)

8.W.1: Write arguments to support claims with clear reasons and relevant evidence.

8.W.2: Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

8.W.7: Conduct short research projects to answer a question (including a self-generated question) drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.

Public Service Announcement Rubric

Category	Above and Beyond 4 points	Proficient 3 points	Developing 2 points	Needs Improvement 1 point
Statistics	• 3 powerful statistics that are not common knowledge • Communicated in a mathematically appropriate form	• 3 statistics are shared but may not be new information • Communicated in a mathematically appropriate form	• 2-3 statistics are shared and may not be new information • Communicated in a mathematically inefficient way	• 1-2 statistics are shared • Communicated inefficiently without employing grade-level appropriate math knowledge
Solutions	• Practical AND innovative solutions provided for all 3 statistics • Supported by mathematical evidence	• Practical OR innovative solutions provided for all 3 statistics • Supported by mathematical evidence	• 2-3 solutions are provided for statistics presented • Solutions may not be innovative or practical • Mathematical evidence weak	• 1-2 solutions are provided for statistics presented • Solutions are not practical • Mathematical evidence lacking
Visuals	• Infographics are used to effectively convey statistics and solutions engagingly	• Infographics are used to convey statistics and solutions but may be unclear	• Infographics are used inconsistently to convey statistics and/or solutions	• Infographics are missing, used sparingly, or do not clearly convey information
Slogan	• Slogan stirs a rich emotional response that matches the argument well	• Slogan stirs an emotional response, but incompletely captures the argument	• Slogan does not create a rich emotional response that matches the argument	• Slogan does not create an emotional response or is missing or unrelated
Production	• Sounds (music, voice) are emotionally appropriate • Effects enhance the presentation and are legible • 7 or more frames are used	• Sounds somewhat match the emotion of the argument • Effects enhance the presentation • 6 frames are used	• Sounds are not affective nor match the emotion of the argument • Effects are inconsistent • 4-5 frames are used	• Sound is distracting, inappropriate, or not used • Few effects were used or are not easy to follow • 3 or less frames are used
Timing	• PSA is 30-60 seconds long and engaging throughout	• PSA is slightly over/under 30-60 seconds long	• PSA is 10 seconds over or under 30-60 seconds	• PSA is more than 10 seconds over or under 30-60 seconds
References	• All (5+) sources are cited and shown in the credits	• Most (3-4) sources are cited and shown in the credits	• Some (1-2) sources are cited and shown in the credits	• No sources are cited or shown in the credits
Title/Credits	• Title is clear, concise, and communicates the message of the PSA	• Title is clear and communicated the message of the PSA	• Title does not effectively communicate the message of the PSA	• Title is not used or does not relate to the message of the PSA
Work Ethic	• Managed time well; finished and had time to edit PSA	• Finished without time for editing	• Finished at the last possible moment due to wasted time	• Wasted time and produced an incomplete product
Presentation	• PSA presented in 3-5 minutes • Clear introduction • Able to answer questions about the PSA and topic	• PSA presented in 3-5 minutes • Introduction given • Able to answer some questions about topic	• PSA presented within 1 minute of the given time frame of 3-5 minutes • Unable to answer questions	• Does not meet time requirements • Unable to answer questions • Missing introduction

Teacher Background Reading List:

Quantifying Solutions to Reduce Our Food's Environmental Impact

Campbell, T. Colin, and Thomas M. Campbell. *The China study: the most comprehensive study of nutrition ever conducted and the startling implications for diet, weight loss and long-term health*. Dallas, Tex.: BenBella Books, 2005.

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List of MARS Tasks Used as Formative Assessments

All MARS tasks and rubrics can be accessed at www.insidemathematics.org

"Giantburger"

Analyzing mathematical claims

Determining missing information required to make an informed decision

Working with exponential notation

"Yogurt"

Ratio and Proportion in real life situations

Scaling up and down

Applications of unit rate

"Fruit Boxes"

Food packaging options

Maximum volume with minimum surface area

PSA Storyboard

As you are planning, consider:

Who is my audience?

How should my audience's attention be grabbed?

Which information is most important and easily understood by the general public?

What action will my audience take as a result of this information?

Organize your information into frames.

Hook	Problem Statement
Claim	Evidence
Reasoning	Action Steps/Takeaway