



Participatory Sensing

A Supplement to Exploring Computer Science, v. 5 (2013)

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This material is based upon work supported by the National Science Foundation under Grant Number 0962919. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

Participatory Sensing Supplement (5 Lessons/class hours)

Introduction

Managing and interpreting data—in a variety of volume, types, and velocity— is part of the foundation of our information society and the economy. The ability to analyze, visualize, and draw conclusions from data sets is an important exercise of citizenship. Effective members of society can collect and analyze data, address their own questions, and corroborate "official statistics" with their own observations.

Exciting new developments in mobile technology are enabling individuals to become active participants in the role of data gathers. Individuals, spontaneous groups of people who self-organize, and community organizations can gather and analyze data, and create understanding of many phenomena. This kind of analysis leverages knowledge in the community, knowledge held by the participants, to tell stories about “who we are” and “how we live.” This process is an example of what we call participatory sensing.

Citizens with mobile devices are also assisting scientists gather massive amounts of data for use in analyzing global climate, animal habitats and populations, human behaviors, and more.... Where there are humans there are data. Participants contribute time, observations, and inventiveness.

This unit has been designed to provide students the opportunity to experience the process of data collection and analysis in real-world contexts by creating their own survey campaigns and to participate in the data collection phase as the first steps in managing and interpreting data, developing understanding, and creating meaning.

The activities in this supplement and subsequent ECS units encourage students to participate in their learning using computational practices.

Unifying Themes and Practices

The primary goal of this supplement is learning about computer science through the operation and manipulation of data—data science—within the context of society. Data science is a subfield of computer science and statistics.

The individual lessons in the ECS course were developed to reinforce the unifying themes and support the use of the computational practices that we expect students to employ.

The three themes are:

- The creative nature of computing
- Technology as a tool for solving problems
- The relevance of computer science and its impact on society

There are many technological tools that enable people to explore concepts and create exciting and personally relevant artifacts that impact society. In this course, programming is used as one of the tools, but not the only tool. Students are asked to be creative in designing and implementing solutions as they translate ideas into tangible forms. As students actively create, they will also discuss the broader implications of computing technologies.

Throughout the course students will gain experience in employing the following computational practices.

- Analyze the effects of developments in computing.
- Design and implement creative solutions and artifacts.

- Apply abstractions and models.
- Analyze their computational work and the work of others.
- Connect computation with other disciplines.
- Communicate thought processes and results.
- Work effectively in teams.

As students design and implement solutions using abstractions and models, they will analyze the processes they and their peers use to arrive at solutions, study the effects of their creations and learn how computing concepts connect explicitly and implicitly to other disciplines. Students will learn about the collaborative nature of computer science by working in teams and communicate the results of their work in writing and orally supported by graphs, visualizations and computational analysis.

The teaching strategies and activities in this supplement and throughout ECS curricula are designed to reflect the themes and encourage computational practices.

Topics to be addressed:

- Nutrition as it relates to health and fitness
- Telling stories and answering BIG questions from data
- Survey design
- Introduction of the Participatory Sensing project

Topic Description:

This Participatory Sensing (PS) Supplement is a critical first step in the Mobilize Prime curriculum. It sets the stage for students to conduct their own PS campaigns and focuses their work in Unit 3 (Web Design) and Unit 5 (Computing and Data Analysis) on a class campaign topic.

This supplement prepares students to engage in their own PS project by analyzing existing data and participating in survey-development processes. Students will explore existing data about nutrition, health, and fitness to discover the connection between the data, the stories it tells, and how data can inform decisions both personal and collective. They will design and participate in a survey (paper-pencil) to add to their understanding of the concepts of gathering useful data, combining data to “discover and describe” new information, and to examine the potential of “scaling-up” data projects. Tasks around designing a survey will include deciding what “BIG questions” a survey can answer and how to write the survey tool prompts/questions to capture the data that will be valuable in answering the BIG questions.

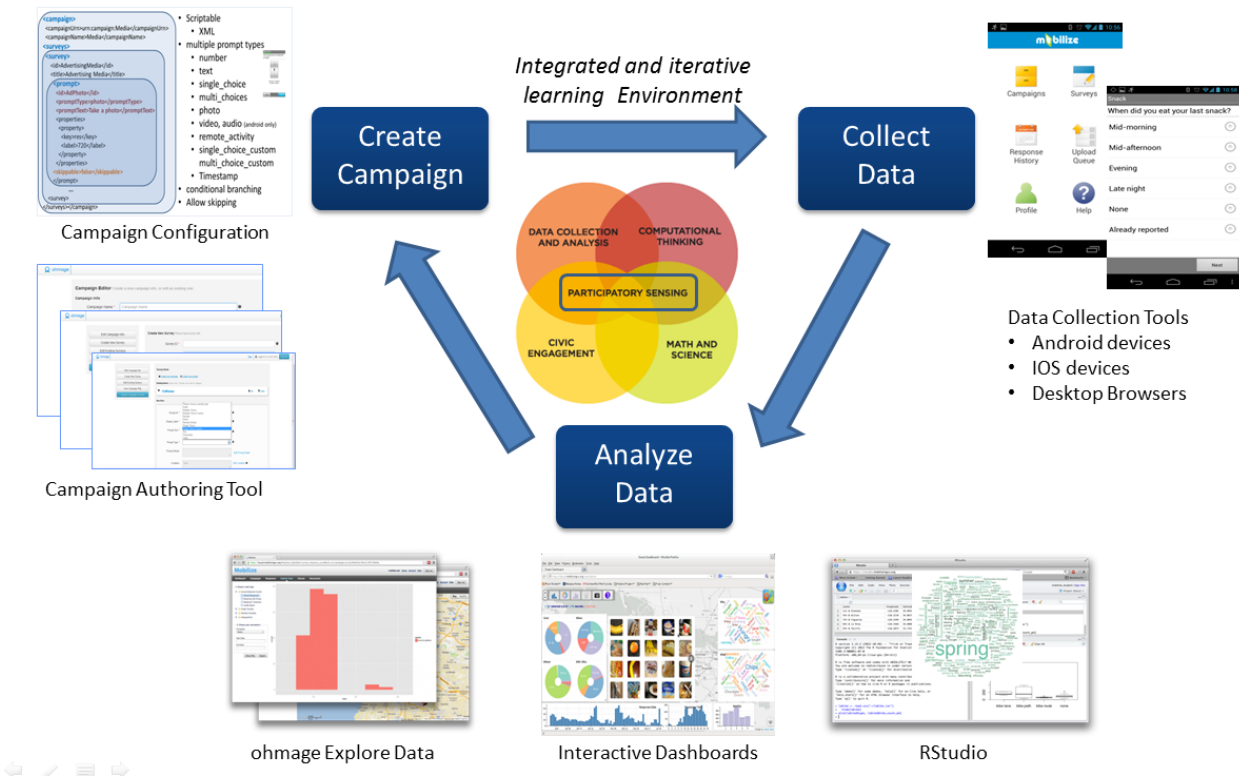
The term “BIG” question is synonymous with “research” or “investigative” question, or can be described by prompting students with, “What story could be told from data on this topic?” The next step is to create the survey questions that would yield the data to answer the “BIG” or “research” or “investigative” questions, or provide the details to “tell the story.”

The Participatory Sensing supplement engages students to see technology as a tool for solving problems and the relevance of data science and computer science to society by connecting computation to a wide variety of disciplines.

By the end of the PS Supplement activities, students will have collaboratively selected a topic that they will use throughout subsequent ESC units. They will have experimented with survey designs, and discovered the best survey questions for gathering data that will support the stories they hope to uncover.



Mobilize: Innovative CS Teaching and Learning



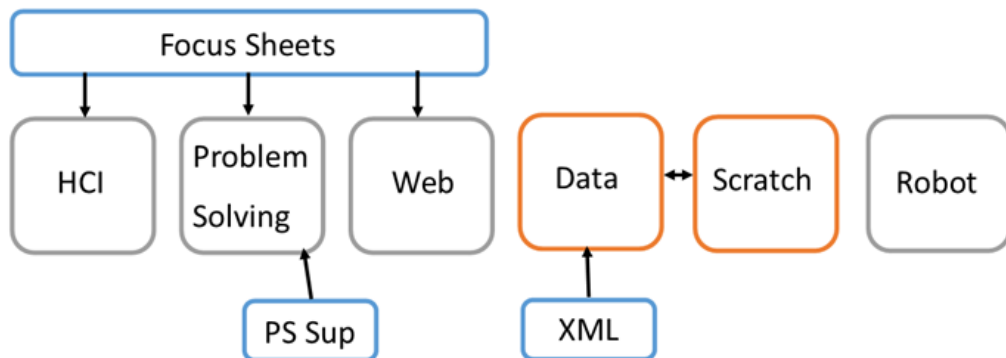
Mobilize Prime enhances the Exploring Computer Science curriculum by adding mobile technology and data analysis to the existing ECS scope and sequence. The following image illustrates how the Mobilize Prime lessons fit into the ECS timeline.

BEFORE & AFTER MOBILIZE PRIME

Normal ECS



ECS w/ Mobilize Prime



Objectives:**The student will be able to:**

- Examine data on the topic of nutrition, health, and fitness to discover the source of statistics found in reports related to nutrition, health, fitness, and obesity.
- Form an important health-related question that can be answered with additional data about snacking.
- Design and implement a paper/pencil survey to gather data about their personal snacking that will further inform the fitness/nutrition topic.
- Analyze the data from their survey to augment, reinforce, tell a story, verify truths, call into question, or further discover and describe information related to snacking and nutrition.
- Explore the four topics for the PS Mobile project to identify meaningful connections to the members of the class.
- Collaborate with class members to select one of the four topics and identify the objectives for the Mobile SP Campaign.

Specific topics for each instructional lesson (50-minute class period) are listed in the Overview Chart.

Overview Chart	
Instructional Lesson	Topic
PS Lessons 1 & 2	Explore nutrition and fitness issue. Analyze Center for Disease Control and Prevention (CDC) data (demonstration of or interact with RStudio or other data analysis application). Identify BIG (research or investigative) questions related to snacking. Develop a paper-pencil survey to record snack consumption by adding questions to a survey template. Homework: collect snacking data.
PS Lesson 3 (not a consecutive day to lesson 2)	Analyze the results of the snacking survey. Look at more snack data such as nutritional content. Draw conclusions from data recorded on personal snacking choices. Answer the BIG questions or tell stories from the data.
PS Lessons 4 & 5	Introduce Participatory Sensing project. Explore four suggested topics with videos and/or web content. Explore data sets for suggested topics. Select a topic that the entire class will focus on. Identify possible BIG questions to address in the survey that will be created in Unit 5.

Participatory Sensing Lessons: 1 and 2

[Back to Unit Overview Chart](#)

Topic Description:

This lesson introduces the topic of how data can be used to learn about nutrition and health, and potentially solve associated problems. Students will use various media to explore the topic and issues, and analyze associated Center for Disease Control and Prevention (CDC) data. A critical step in this lesson is to guide students into forming BIG questions that can be answered with additional data about their personal snacking habits and developing a survey using a template to gather the information.

Objectives:

The student will be able to:

- Describe health risks associated with poor nutrition.
- Explain the many factors that influence poor nutrition.
- Analyze CDC data.
- “Tell stories” from the CDC data set.
- Formulate questions that can be answered by gathering personal snacking data.
- Develop a survey to explore their personal snacking habits.

Outline of the Lessons:

PS Lesson 1:

- Journal Entry: What health problems are associated with poor nutrition? Why is poor nutrition and associated health problems common in the US? (5 minutes)
- View online video: The Obesity Epidemic. (10 minutes)
- Discuss with an elbow partner; share with the class or use a Think-Pair-Share strategy: (10 minutes)
- Demonstrate/display the data in the CDC data set with the **Add to My Story** activity. (10-15 minutes)
- Discuss what could be learned from examining personal snacking information. (10-15 minutes)

PS Lesson 2:

- Each team identifies a BIG question they would like to answer with their snacking survey (10 minutes).
- Discuss how to form good survey questions to get at the desired information. (10-15 minutes)
- Students work with a partner to formulate questions to include on a survey for recording their snacking habits. (10 minutes)
- Develop a snacking survey using the survey template. (10 minutes)
- Assign homework. (5 minutes)
- Optional: Demonstrate the BMI calculator. (5 minutes)

Lesson 1 Instructional Details

Student Activities:

- Journal Entry: Speculate on why nutrition-related problems are common in the US.

- View the video and speculate on how snacking can impact an individual's health. Discuss with an elbow partner; share with the class).
- View the data of the CDC data set with RStudio (teacher demo) and summarize a story with an **Add to My Story** activity (activity student pages follow this lesson).
- Speculate on the stories that might be told from their personal snacking data. (Think-Pair-Share)

Teaching/Learning Strategies:

- Journal Entry: List health problems associated with poor nutrition. Why is poor nutrition and associated health problems common in the US?
 - Have students write responses to the prompt in their journals and then share the responses with their elbow partners.
 - Ask a few student pairs to share their responses.

It is important to be sensitive to the health and weight of students in the class. If there are overweight or underweight students who may be sensitive to the topic of obesity/weight, focus on the benefits of being fit and physically active and on healthy eating, rather than on weight issues. An alternative anticipatory question can be used: How do food choices impact the health of the US population?

Never let other students tease or place the blame for obesity/weight problems on the individual in a hurtful manner (i.e. laziness, unintelligent, lack of self-control, etc.) For more information on how to be supportive of over/underweight students, talk with the school guidance counselor, physical education teacher, nurse, or other health professional. Focus on health, not weight. Remember, the key issue is the teen's health, not his or her weight.

Suggestions for keeping the classroom a welcoming place for all students:

- **Don't** make the focus about dieting.
- **Don't** label foods as "bad" or off-limits, but do encourage healthy portions.
- **Don't** reward weight loss/gain. Instead, offer support and compliments for healthy choices.
- **Don't** focus on changes that only over/underweight children need—**everyone needs to make healthy food choices.**
- **Don't** be critical when students make less than perfect choices.
- **NEVER** tolerate weight-based bullying or teasing.
- Show the video: *The Obesity Epidemic*, National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition, Physical Activity and Obesity
<http://www.cdc.gov/CDCTV/ObesityEpidemic/index.html>.
 - See other videos listed in the resources section that can be used as a replacement as appropriate to fit classroom needs.
- Bring the discussion back to snacks. Discuss the video with an elbow partner and speculate on how snacking can impact student's health. Share out with the class. What portion of a teenager's food consumption comes from snacking? What nutritional value do popular snacks contribute to teenage diets? How does it impact students' health and fitness? Describe ways in which an individual's snacking habits can impact more than just that individual?
- Create class list of results from discussion (optional).

- Ask students to identify snacks that contribute nutritional value to their diets and those that are not as valuable. Ask, “How do you know the difference between more-nutritional and less-nutritional food?”
- Demonstrate/display (or have students, working with a partner examine) the CDC data set in RStudio.
 - See **Teacher Instructions CDC** for directions on how to display the data set in RStudio.
 - Students identify variables and draw conclusions on the **Add to My Story** student activity page. The **Add to My Story** learning strategy involves sharing ideas with classmates by adding storylines to the activity document and passing to other students (see Teaching Strategies Resources section at the end of this supplement). The last question asks students to speculate on what stories could be told by examining their personal snacking habits and those of their classmates.
- Discuss what could be learned from examining personal snacking information by asking students to share an idea from the **Add to My Story** activity. Focus the discussion on these ideas:
 - How can personal data add to the understanding of the CDC data?
 - What important questions could be asked about one’s snacking behaviors that would help individuals to think critically about their own habits and be empowered to eat better?
 - What details or information (variables) will be needed to analyze snacking habits?

Lesson 2 Instructional Details

Student Activities:

- Discuss how to create good survey questions that will yield the data needed to answer the BIG questions.
- Students work with a partner to formulate questions to include on a survey for recording their snacking habits in order to describe or discover more about their snacking. Refer to Step 6 on the **Add to My Story** from PS Lesson 1.
- Develop a snacking survey using the **Survey Template**.
- Homework: Record snacking habits for 3-4 days (or as directed by teacher) on the **Survey Template**. Self-analysis using the BMI calculator.

Teaching/Learning Strategies:

- Announce plans for teams of three students to conduct a small snacking self-survey to explore personal snacking habits. Tell students that each team will:
 - Formulate a BIG question for their team.
 - Add a few questions to the survey that they determine will elicit the data they need to answer their BIG question.
 - Keep track of their personal snacking habits for 3-4 days.
 - Analyze the data they gather.
 - Draw conclusions to answer their BIG question.
- Discuss how to write questions for useful surveys that will reveal the information needed to answer BIG questions. Discuss how observational skills and bias can impact the data collected

and impact the conclusions. Use content from

<http://www.shmoop.com/basic-statistics-probability/designing-study.html>

- Guide student teams to formulate BIG questions to help focus their snacking surveys.
 - Form teams of three students. For this first stage of the project, a team reporter needs to be selected. The role of the reporter is to keep accurate records of team decisions throughout the survey design process.
 - Each team decides upon a BIG question they would like to learn about in their snacking survey. Examples: What time of day is most common for unhealthy snacking? What is the result of replacing meals with snacks? How many calories a day come from nutritionally less-dense foods (junk food)? What role does fast food play in snacking? Do friends and acquaintance impact snack choices? Where are the most nutritional snacks purchased and/or consumed?
- IMPORTANT: Guide students in a discussion of questions that data analysis can and cannot answer. How do they determine what can be answered and what cannot?
- Team members formulate questions (2-4) for a snacking survey that will elicit the data that can be used to describe or discover more about their snacking and nutritional habits and answer their BIG question. Add the questions to the existing content on the *Survey_Template.doc*.
 - Some of the variables (snack item, cost, location, etc.) have already been included on the **Survey Template** student activity page. Each team should add additional questions that will get at the information they need in order to answer the “BIG question” or tell the story they want to tell.
 - Teams use the checklist on the **Survey Template** student activity page to help determine if they have written “good” survey questions.
- Assign snacking survey as homework. Set expectations and due date (3-4 days). Students will likely be able to record at least 2 snacks each day. More days will yield more data and better enable students to draw conclusions, answer their BIG question, and tell a story.
 - Students should:
 - Collect the wrappers for all wrapped snacks they have eaten.
 - Clearly identify the food if the item is a fast food snack (so they will be able to find nutritional data online).
 - Sketch the snack item in accurate dimensions if it is other than wrapped or fast food.
- Optional: Demonstrate the BMI calculator (Link included on the survey template but the activity is intended to be a private student experience, not to be completed in the classroom.)

Required Files and Resources:

- Obesity Epidemic <http://www.cdc.gov/CDCTV/ObesityEpidemic/index.html>
- cdc.rda (data set)
- RStudio <https://rstudio.mobilizingcs.org/> or other data analysis tool
- Basic Statistics and Probability <http://www.shmoop.com/basic-statistics-probability/designing-study.html>

- *Basics of Designing Questionnaires*
<http://managementhelp.org/businessresearch/questionnaires.htm#anchor865551>
- *Do parent really know what their kids are eating? (an audio news report)*
<http://www.npr.org/blogs/thesalt/2013/02/27/173000238/do-parents-really-know-what-their-kids-are-eating>

Student activity documents are included as pages within the text of this lesson document:

- Add to My Story.doc
- Survey_Template.doc
- Teacher_Instructions_CDC.doc

Other Resources:

- Finding a Balance <http://www.cdc.gov/CDCTV/FindingBalance/index.html>
- Fruit/veg consumption related to health
<http://www.cdc.gov/nutrition/downloads/StateIndicatorReport2009.pdf>
- Read about using the BMI for children and teens.
http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html
BMI Calculator:
http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html
- Making a difference at your school: CDC resources for preventing childhood obesity
<http://www.cdc.gov/healthyyouth/keystrategies/pdf/make-a-difference.pdf>
- Designing Surveys That Count <http://www.keene.edu/crc/forms/designingsurveysthatcount.pdf>

Add to My Story

Name _____

CDC Data Overview

The CDC data set is information gathered through a survey of students by the Centers for Disease Control and Prevention (CDC). The CDC is part of the Department of Health and Human Services and addresses health issues in the United States. (<http://www.cdc.gov/healthyyouth/yrbs/>).

Follow along with the teacher to view the data. How many variables are included? _____

In the table below list 8 variables you see in the data set and one sample entry for each.

Variable	Sample data entry	Data type (categorical, numeric, range, text, image, location, time)

How many observations were included in the ORIGINAL data set? _____ (Hint: Look at the top of the cdc data pane.)

How many rows are included in this DISPLAYED subset? _____

Define subset.

Participate in an “Add to My Story” activity.

Step 1: Look at the variables. Using 2 or more variables, identify a comparison or question that might create an interesting story about this data. Example: How many girls drink milk?

Step 2: Pass your paper to another student who will add a line to your story using one of the variables used in the first story line.

Step 3: Pass the paper on to yet another student who adds another line using one of the variable from the previous line.

Step 4: Continue until the teacher stops the activity. Retrieve your original paper.

Storyline #1:

Storyline #2:

Storyline #3:

Storyline #4:

Storyline #5:

Storyline #6:

Storyline #7:

Storyline #8:

Step 5: Select an interesting and meaningful story line from the list and tell why you find it interesting.

Step 6: Journal Entry: What story might be told about the health of you and your classmates with a survey on snacking habits? Have students write responses to the question in their journals and then share the responses with their elbow partners. Ask a few student pairs to share their responses.

Snack Survey Template

Page 1

Team members:

Your Team's BIG QUESTION:

Questions already included in the survey:

1. What snack did you eat?
1. Approximate cost (Answer choices: <\$1.00; \$1.00 – 3.00; \$3.00 – 5.00; \$5.00 – 7.00; \$7.00 – 10.00; > \$10.00)
2. How nutritional was it? (Rate on a scale of 1 to 5)
3. Where did you eat? (Answer choices: Home; School; Work; Restaurant; Friends' house; Vehicle; Party; Other)
4. Who were you with? (Answer choices: Alone; Family; Friends; Classmates; Co-workers; Other)
5. Why did you eat?
6. Collect labels. If the food did not come from a fast food restaurant and no label is available, sketch an accurate size image of the snack on the back of the survey document.

What questions do you need to add to the survey to elicit the data needed to answer the BIG question (2 – 4)?

1. –
2. –
3. –
4. –

Look at your questions above. Place a check mark to the left of each question that satisfies all of these criteria indicating that it is a "good" question. Modify questions that do not meet the criteria.

- Does not include slang, cultural-specific or technical words.
- Avoids strong words or adjectives that might influence the respondents' answer (good, excellent, bad, best, worse)
- Ask one question at a time; avoid use of the word "and" in your question.
- Avoid using "not" in your questions if you're having respondents answer "yes" or "no" to a question.
- If you use multiple choice questions, be sure your choices are mutually exclusive and encompass the total range of answers.

Question #1: What snack did you eat? [Open-ended response] Examples: apple; Cheetos; a peanut butter cookie; a Big Mac

Question #2: Approximate snack cost? [Answer choices: <\$1.00; \$1.00-\$3.00; \$3.00-\$5.00; \$5.00-\$7.00; \$7.00-\$10.00; >\$10.00]

Question #3: Where did you eat? [Answer choices: Home; School; Work; Restaurant; Friends' houses; Vehicle; Party; Other]

Question #4: Time? [Answers: morning; mid-morning; noon; mid-afternoon; after school; before bed; late/middle of the night]. The implication is that snacks might be a meal replacement so the time of day can be anytime when food is consumed.

Question #5: Who were you with? [Answer choices: Alone; Family; Friends; Classmates; Coworkers; Other]

Question #6: Why did you eat? [Open-ended response] Examples: Hungry, Annoyed, Bored, Lonely, Sad/Depressed, Thirsty, Happy, Socializing

Question #7: How healthy was the snack? [Rate between 1-5]

Add additional information about the 2 -4 questions you added to the survey.

Question #8:

Question #9:

Question #10:

Question #11:

*Collect the snack wrapper or sketch the snack with realistic size and label on the back of the survey.

Optional homework: BMI calculator

Read about using the BMI for children and teens.

http://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

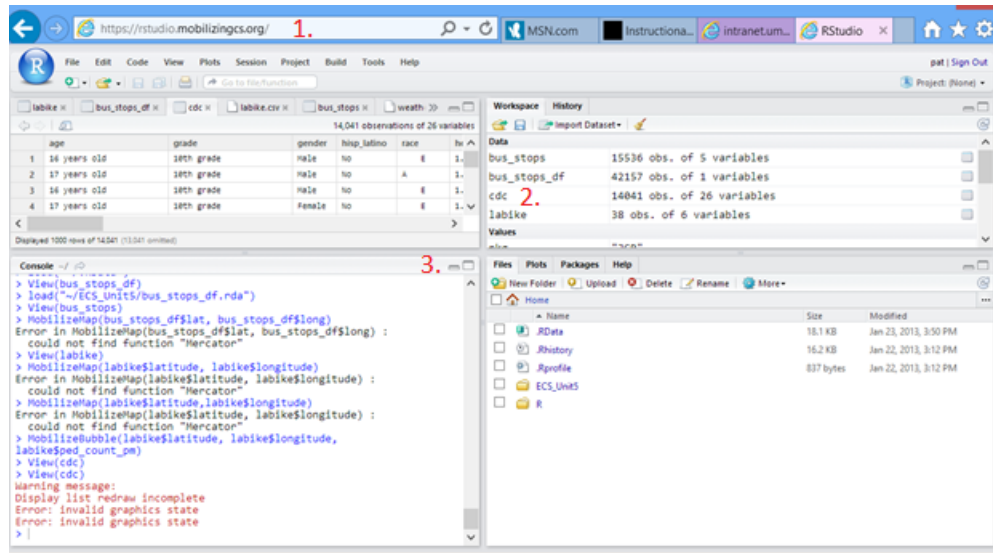
BMI Calculator:

http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/english_bmi_calculator/bmi_calculator.html

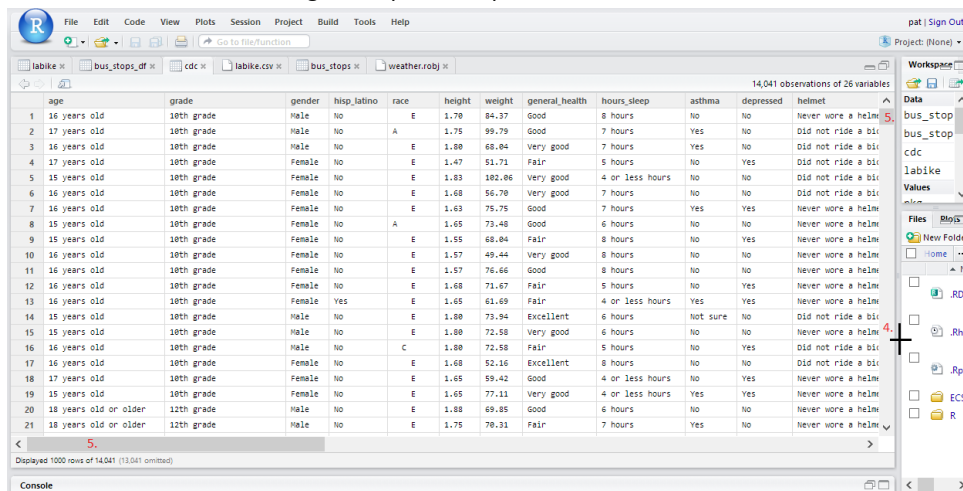
Snack item	Cost	Location	Time	Alone/friend/family	Reason	Nutritional rating 1-5				

Teacher instructions CDC: Reviewing Center for Disease Control (CDC) Data Set

1. Open the CDC data set in RStudio.
2. Click on “cdc” on the Workspace tab. The data set will open on a “cdc” tab in the top left pane.
3. Minimize the Console pane by clicking on the minimize icon.



4. Expand the data set pane by dragging the right edge of the pane to the far right. More records and variables are now visible.
5. Scroll through the data using the scroll bars along the bottom and right side.
6. Look at the “variables” along the top of the spreadsheet.



Invite students to think about the stories they might be able to tell by comparing and asking questions of the data using the **Add to My Story** activity. They will learn more about data analysis in Unit 5.

Examples to get them started:

1. How many students who wear a bike helmet also wear seatbelts? How does this compare to those who

wear seatbelts but not a bike helmet?

2. Are students who eat salad more likely to have excellent health than those who do not?

Snack Survey Analysis

Name _____

What is your team's BIG question?

1. Examine the data in your paper-pencil survey. Draw conclusions by comparing the data you recorded for these variables.
 - How many snacks did you record?
 - What was the most expensive snack? Least expensive?
 - What was the most common reason for snacking?
 - How many snacks were rated 3 or better for nutritional value?
 - Who were you with most often when you snack?
2. Now compare the data by analyzing these variable pairs.
 - What do you notice about the nutritional value of snacks you ate before bedtime or late night?
 - When do you eat the most expensive snacks?
 - What can you say about the snacks you consumed when alone? With friends?
 - Where do you tend to eat the most nutritious snacks?
3. What other variables did you include in the survey?
4. Draw a conclusion by comparing at least one of those variables with another of the original survey variables.
5. Draw a conclusion by comparing two of the variables you added to the survey.
6. Can you answer the BIG question?
 - a. If not, why not?
 - b. Do you need additional information?
 - c. What other variable(s) would you need to add to the survey to better answer the BIG question?
7. Rate the effectiveness of your survey from 1-5. Explain your rating.

PS Lesson: 3

[Back to Unit Overview Chart](#)

Topic Description:

This lesson will guide students in basic data analyze of the results from their snacking data survey. Students will draw conclusions, compare to the CDC data set, and attempt to answer their BIG questions or tell stories about their snacking as it relates nutrition and health. To finalize the results and inject more data, students will dig deeper into the nutritional information for the consumed snacks.

Objectives:

The student will be able to:

- Analyze the data they have collected.
- Gather additional nutritional information about the consumed snacks.
- Make connections to the CDC data. Compare and contrast with the data in the CDC data set.
- Connect with the information in the *Obesity Epidemic* (or other introductory video).
- Draw conclusions about their own snacking habits as they relate to their current and future health.
- Speculate on what might be learned is this survey project could be scaled up to include more individuals. To what groups could it be expanded?

Outline of the Lesson:

- Journal Entry: Summarize what snack survey data initially tells. (5 minutes)
- Use the **Snack Data Analysis** student activity page to analyze the snack data. Identify any shortcomings of the collected data. (15 minutes)
- Research and record additional nutritional information on snacks. (15 minutes)
- Answer BIG questions. (5 minutes)
- Compare and contrast student information with the CDC data set and the introductory video. (10 minutes)

Student Activities:

- Journal Entry: Summarize in two sentences what your snack survey data tells you. Add comments to your journal.
- With your team, use the **Snack Data Analysis** student activity page to analysis snack data. Identify any shortcomings of the collected data.
- Research and record additional nutritional information using **Snack Nutritional Value** student activity page.
- Write the answer to the team BIG question on paper to display.
- Compare and contrast student information with the CDC data set and the introductory video.

Teaching/Learning Strategies:

- Journal Entry: Summarize in two sentences what your snack survey data initially tells you.
 - Have students write responses to the question in their journals and then share the responses with their elbow partners.
 - Ask a few student pairs to share their responses.
- Use “snackboard” (a visualization tool that is developed specifically for the combined Mobilize snack data collected by students during 2012) as a motivation for participatory sensing. It is

interactive and allows students to easily explore data with images.

<https://lausd.mobilizingcs.org/snackdemo>.

- Guide student teams to analyze the snack data with the **Snack Data Analysis** student activity page.
- Discuss the difficulty of accurately analyzing how these snacks might impact their health with only the limited data they have. List other pieces of data (variables) that would further describe their snacks and how they might impact their health. What questions would they need to ask to get to that data? What could they learn if the survey was scaled to include more people?
- Research and record additional nutritional information using the **Snack Nutritional Value** student activity page.
 - Information for the various nutrient categories on the activity sheet can be located on the snack label or various nutritional websites. The *Common Foods Comparison* website will be useful for fast food snacks (http://www.sparkpeople.com/resource/food_lists_snacks.asp). An electronic spreadsheet (*Snack Nutritional Values.xls*) can be used for this activity as well.
- Teams record the answers to the BIG questions they posed or tell a story on large sheets of paper. Display the responses on the class wall. As a class, rearrange the “stories” into categories. Are there any “bigger stories” that these groupings tell?
- Compare and contrast student information with the CDC data set and the introductory video. Post these questions for their consideration. Discuss with an elbow partner; share out with the class:
 - Does your personal survey data support CDC data?
 - Does it refute the CDC data?
 - In what ways does it add to the CDC data?

Required Files and Resources:

- Common Foods Comparison http://www.sparkpeople.com/resource/food_lists_snacks.asp

Student activity documents are included as pages within the text of this lesson document:

- Snack Data Analysis.doc
- Snack Nutritional Values.doc
- Snack Nutritional Values.xls (optional)

Other Resources:

- Find Healthy Snacks <http://caloriecount.about.com/calories-snacks-ic2500>
- Video and label details: *Reading Food Labels*
<http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm079449.htm#video>

Snack Data Analysis

Name _____

What is your team's BIG question? _____

1. Examine the data in your paper-pencil survey. Draw conclusions by comparing the data you recorded for these variables.
 - How many snacks did you record?
 - What was the most expensive snack? Least expensive?
 - What was the most common reason for snacking?
 - How many snacks were rated 3 or better for nutritional value?
 - Who were you with most often when you snack?
2. Now compare the data by analyzing these variable pairs.
 - What do you notice about the nutritional value of snacks you ate before bedtime or late night?
 - When do you eat the most expensive snacks?
 - What can you say about the snacks you consumed when alone? With friends?
 - Where do you tend to eat the most nutritious snacks?
3. What other variables did you include in the survey?
4. Draw a conclusion by comparing at least one of those variables with one from the original survey.
5. Draw a conclusion by comparing two of the variables you added to the survey.
6. Can you answer the BIG question?
 - a. If not, why not?
 - b. Do you need additional information?
 - c. What other variable(s) would you need to add to the survey to better answer the BIG question?
7. Rate the effectiveness of your survey from 1-5. Explain your rating.

8. Visit this link to “snackboard.” Discover the power of participatory sensing and data analysis as you easily explore data with images. What information did you discover from the snackboard that you didn't know? <https://lausd.mobilizingcs.org/snackdemo>

Snack Nutritional Values

Name _____

Record the nutrients in the snack you consumed in the chart below.

To find the information use:

- The information from the food labels
- Common Foods Comparison http://www.sparkpeople.com/resource/food_lists_snacks.asp
- Find Healthy Snacks <http://caloriecount.about.com/calories-snacks-ic2500>

For videos and information on reading food labels visit: *Reading Food Labels*

<http://www.fda.gov/Food/ResourcesForYou/Consumers/ucm079449.htm#video>

Snack	Calories	Fat (grams)	Carbohydrate (g)	Protein (g)

All food calories come from fat, carbohydrate, or protein.

A gram of fat has 9 calories.

A gram of carbohydrate (starch, sugar, alcohol) has 4 calories.

Draw two conclusions about the snacks you eat based upon calories and other nutrients.

1. –

2. –

Do you think that any of the questions in the survey are biased in anyway? Explain your answer.

PS Lessons: 4 and 5

[Back to Unit Overview Chart](#)

Topic Description:

In anticipation and preparation to the Participatory Sensing (PS) project, students will explore four topics and select one for the class PS project. The selected topic will be the focus of their work in Unit 3 (Web Design) and Unit 5 (Data Analysis).

Objectives:

The student will be able to:

- Summarize the survey development process.
- Explore four topics with videos, other visuals, and data sets.
- Identify BIG questions that could be answered or stories that could be told from the data.
- Select one topic for the class project.
- Form teams, assign roles, begin a list of possible BIG questions and stories to explore.

Outline of the Lessons:

PS Lesson 4:

- Summarize the survey development process from the snacking project. (5 minutes)
- Describe the upcoming class PS project (10 minutes)
- Introduce two topics with videos or other visuals. (15 minutes)
- Examine the available data sets on these topics. (15 minutes)
- Discuss possible BIG questions that might be answered or stories that might be told with additional information. (5 minutes)

PS Lesson 5:

- Introduce two additional topics with videos or other visuals. (15 minutes)
- Examine the available data sets on these topics. (15 minutes)
- Discuss possible BIG questions that might be answered or stories that might be told with additional information. (5 minutes)
- Select 1 topic for the class project. (10 minutes)
- Form teams, assign recorders, begin a list of possible BIG questions and stories they might like to explore. (10 minutes)

Lesson 4 Instructional Details

Student Activities:

- Recall the survey development process from the snacking project.
- Explore two topics with videos or other visuals.
- Analyze the available data sets for those topics.
- With an elbow partner discuss possible BIG questions that might be answered or stories that might be told with additional information. Share out with the class or use a journaling strategy.

Teaching/Learning Strategies:

1. Summarize the survey development process from the snacking project with the use of the **Survey Flow Chart** student activity page. Project the chart for easy classroom viewing. Engage students in filling in the steps. Compare this process to the scientific process or other problem-solving strategies. The resulting plan for executing this project is an algorithm.
 1. Ask a BIG question
 2. Design a strategy (survey) to find the answer.
 3. Write questions that will provide data to answer the question.
 4. Collect data
 5. Analyze the data
 6. Tell the story or answer the question using the data
- Describe the upcoming project of a class PS project that will follow the same algorithm.
 - The CLASS will select from one of the topics they will learn about over the next two days through videos, articles, and data sets.
 - Each team will decide on the BIG questions to ask about the data and the story they hope to tell. Each team will pose their own BIG questions. Each team will contribute questions to the survey in order to gather the data necessary to answer their BIG questions.
 - Design the survey to get at the information they need to tell the story.
 - Create a mobile survey tool with XML that will be available on their phones.
 - Gather data by using the phone survey.
 - Analyze their collected data and data from other sources.
 - Draw conclusions, augment, reinforce, tell a story, verify truths, call into question, or further discover and describe the topic.
 - Report their findings on their website design project.
- Introduce two topics with a video or other visual. See **Data Analysis Scaffold** document.
- Examine the available data set on each topic in a data analysis tool such as RStudio (similarly to how the CDC data file was examined).
- So that every student has the same information when teams are formed and decisions made, it is suggested that the **Topic Selection Guide** student activity page be used to support student review and analysis of each possible topic. All four topics are included on the **Topic Selection Guide** document.
- Discuss possible BIG questions that might be answered or stories that might be told with additional information.
- **IMPORTANT CONSIDERATION:** The size of data sets for the four topics varies significantly in the number of variables. The complexity of the data sets adds to the complexity of strategies for analyzing the data and to the conceptual complexity for students to process the information, formulate research questions, and execute a successful project. The variables in the two larger data sets (Topics 3 & 4) have been rearranged to enable projects to be scaffolded more easily. It might be useful to guide students toward project topics or to subtopics within the four major topics that match their needs and resources.

The numbering of topics (1 – 4) in the **Data Analysis Scaffold** document (and below) indicates increasing complexity. Each topic can be more narrowly focused to make the content manageable for most learners. Refer to the Possible BIG Questions in the Data Analysis Scaffold document for scaffolding suggestions.

Lesson 5 Instructional Details

Student Activities:

- Learn about two more topics with videos or other visuals.
- Examine the available data sets for these topics.
- With an elbow partner discuss possible BIG questions that might be answered or stories that might be told with additional information.
- Form a team, select the topic, and assign a recorder.

Teaching/Learning Strategies:

- Introduce other two topics with videos or other visuals.
- Examine the available data sets on each topic. Continue using the **Data Analysis Scaffold** document and **Topic Selection Guide** student activity page from Lesson 4.
- Discuss possible BIG questions that might be answered or stories that might be told with additional information.
- Guide students to select a topic for their project. It is recommended that the entire class should use the same topic, and individual teams ask different BIG questions and include variables in the survey campaign to gather data unique to their questions. Use a modified **Salesperson Strategy**.
 - Take a class vote on the topics.
 - Select the top-two vote getters. Gather the individuals who voted for each of the top two. Select someone from each of the two groups as a salesperson for that topic. The salesperson confers with other students who voted for that choice to solicit reasons why the class should vote for that topic. The salesperson's task is to "sell" the idea to the rest of the class. The salesperson should give three reasons why their topic choice is the best choice for the class. They might cite reasons why the topic is significant to the class members, their families, teenagers, or their futures. They might cite actions that could come from their research. They might connect it to current events.
 - After each salesperson has had one or two minutes to make their appeal, the class votes again. The topic that receives the greatest number of votes is the topic the class will use.
 - Talk about consensus. Reassure students that there will be many opportunities in the project for them to add their ideas and creativity.
- An alternative strategy is to allow teams to select from the top two vote getter topics or for teams to select their own topic from the suggested four topics. This might be advantageous if there are students who feel strongly about a topic other than the single topic selected with the Salesperson strategy. It is recommended that the topics be limited to the four suggested in this unit because students will have easy access to the contextual data files for their analysis.
- Form teams of three students. Use the **Team Up** strategy described in the **Pedagogy** section of Lesson 5. Assign a student as the initial "Recorder and Store Keeper." Use the **Team Role Cards** to assign student roles within their team. Roles should rotate every few days. (Other roles include Designer/Guide, Driver, and Encourager/Spy.)

- Effective student project teams are critical elements to successful computational thinking classrooms. Engaging in team-building and class-building activities ideally start on the first day of class and includes strategies to improve communication and social skills in class projects. Setting clear expectations and carefully selecting team members are important first steps. Teams that will function over a short period of time can be formed by selecting students randomly; when used often, this is a good way to introduce students to others in the class. A project that will extend over a long period of time requires thought and consideration of several aspects of effective teams.

Considerations for working with student teams:

- Groups of three students seem to work well for computer projects. Depending upon project expectations, duration and size of the project, and the number of computers available, this number may expand to four or more students.
- Who do students like to work with? This might be very different than who they work well with! Give students some choice in their teammates. Asking each student to list four other students they would like to work with and then selecting at least one of them to be on the team, recognizes students' needs for comfort and familiarity.
- Avoid pairing students with obvious personality conflicts. Save these matches for projects of short duration. It is important for students to learn to work with others but may not be worth the problems inherent in a long-range commitment.
- Is there a diversity of talent among the members of the team? Ensure that teams are reasonably well balanced between students with more and less experience and background related to the project.
- Have a plan in place if team conflicts arise and cannot be resolved. Students should know about this plan at the outset of the project.
- As time permits, begin a concept map and list of possible BIG questions and stories. Use **PS Kickoff** student activity page.
- More details about working with student development teams are available in the XML Supplement.

Future Impact of Lessons 4 and 5: Unit 3 Web Design

The topic selected during these PS Supplement activities will be the subject of students' website projects in Unit 3. During Unit 3 it will be important for students to think about their teams' BIG questions as they research and gather more information on the topic for the website. Ultimately, after they complete their research/survey campaign in Unit 5, they will add data/graphs from the survey to their website as a part of their final presentation.

During Unit 3 periodically remind students of the upcoming data-gathering campaign and analysis. Guide students to practice computational practices. Use computational terms in class discussion and instructions. Help students to include the terms in talking about their projects.

decomposition - breaking problems down into smaller parts that may be more easily solved.

abstraction - simplifying from the concrete to the general as solutions are developed.

negotiation - groups within the team working together to merge parts of the solution into a whole.

consensus building - working to build group solidarity behind one idea or solution.

Required Files and Resources:

- Refer to the **Data_Analysis_Scaffold.doc** (also included below) for introductory materials and data files for each topic. Select as appropriate for the class.
- Specific data sets found in the “Data Sets lesson 4-5” folder within the “PS Supplement Resources” folder.
 - Mobilize_SchoolSafety_2011.csv
 - Mobilize_ExerciseHealth_2011.csv
 - Mobilize_MediaBehavior_2011.csv
 - Mobilize_GamesCivic_2008.csv
- Teacher reference: **DataSet_Quest-Ans_Codes.doc** for survey questions and answer codes.

Student activity documents are included as pages within the text of this lesson document:

- Survey_Flow_Chart.doc.
- Topic_Selection_Guide.doc
- PS Kickoff.doc
- Role cards.doc

Other Resources:

- The Human Face of Big Data. Rick Smolan, Jennifer Erwit. November 20, 2012 | ISBN-10: 1454908270 | ISBN-13: 978-1454908272. AgainstAllOdds.com.
- Learning about Statistics videos <http://www.neok12.com/Statistics.htm>
- Statistical Graphs http://math.youngzones.org/stat_graph.html
- Basic Statistics and Probability <http://www.shmoop.com/basic-statistics-probability/designing-study.html>

Data Analysis Scaffold: Four topics with data analysis and BIG question ideas

Successful participatory sensing and data analysis projects will be the result of students being engaged in the topic and in their ability/preparation to conceptualize, plan, and execute research on a related issue. Student preparation can be enhanced by using a “scaffold” approach in teaching them about data analysis, in helping them select research topics, in guiding them to ask BIG questions about the topic, and in planning for the research and analysis.

1. Introduce students to the possible research topics by using the suggested videos or other high-interest and engaging resources. The goal is to spark their interest and desire to learn more about the topic, and to brainstorm how they can be citizen scientists on the topics. The topics in the chart below are arranged from less- to more-complex in the number variables in the associated data sets and potentially broader range and abstractness of related concepts.
 - a. School safety and bullying
 - b. Teen exercise and health
 - c. Teens, social media, and online behavior
 - d. Teens, video games, and civic engagement
2. Demonstrate data analysis techniques using the data set associated with each topic. The data sets are located in the Resources folder. The goal is for students to see how large data sets can be made understandable with analytical techniques. They may want to suggest comparisons of their own to discover other relationships and to tell other stories from the data. Use the chart below to guide students from simpler toward more advanced analysis techniques for each topic. The strategies scaffold from those requiring very basic thinking toward those requiring more complex analysis.
 - a. Begin by demonstrating Data Analysis techniques in RStudio or other data analysis tool.
 - b. Select a starting point within the numbered list appropriate for the development and skill level of the class and progress through the list as time and student interest allows.
3. The BIG Question suggestions for each topic are also in a scaffold order and are intended for use in guiding students toward participatory sensing research ideas that they will conduct in Unit 5. The goal in exploring BIG questions at this time is to stimulate students to think about what could be learned from data on a particular topic if other/additional questions were asked. Prompt them with “What story on this topic would be interesting or important to tell if you had the right data?” **IMPORTANT:** The questions listed cannot be answered from the data set provided. The list is not intended to be exhaustive; students will likely have other valuable BIG questions to explore. Important considerations in selecting BIG questions include:
 - a. The complexity of the question relative to the students’ time and other resources to successfully complete the project.
 - b. Opportunities to gather data that will inform/answer the question.

Data Analysis and BIG Questions Scaffold

Topic 1: School Safety and Bullying

Introductory Resources:

- Bullying facts from the National Assoc. of School Psychologists:
http://www.nasponline.org/resources/factsheets/bullying_fs.aspx
- More facts about bullying: <http://facts.randomhistory.com/facts-about-bullying.html>
- Youth Online: Visit <http://apps.nccd.cdc.gov/YouthOnline/App/Default.aspx>. Select a state by clicking on the map. On the Table tab, select “Unintentional Injuries and Violence.” (Other filters for race or age can also be selected). Select to “View Data by Demographics (Totals, Sex, Race, or Grade). Click “GO.” View the Table or Graph by selecting the appropriate tab. Focus on the questions related to bullying.
- See the state-by-state grades for anti-bullying laws: <http://www.bullypolice.org/>
- YouTube video: You Are You <http://www.youtube.com/watch?v=l8ovOA7VhFo>
CAUTION: Preview before showing to evaluate suitability for your classroom.

Data analysis

Data set file:

Mobilize_SchoolSafety_2011.csv

See **DataSet_Quest-Ans_Codes.doc** for survey questions and answer codes.

1. What percentage of students who responded to the survey has been bullied at school? Electronically?
2. What is the typical number of days that students felt threatened at school? How variable is the number?
3. How many students who have felt unsafe at school have talked to a teacher about it?
4. Who (age, gender) is most likely to get help with bullying?

BIG idea questions

1. How does experiencing bullying impact one’s willingness to help others being bullied?
2. What support strategies could be used to help victims of bullying?
3. How does intervening with bullies impact the bullies’ behavior?
4. Does the number of close friends a person has impact the likelihood of being a victim?
5. What strategies defuse bullying?
6. What motivates bullies? Are there “trigger events?”

Topic 2: Exercise and Health

Introductory Resources:

- FitWebMD: <http://fit.webmd.com/teen/move/article/exercise-personality>
 - Play Bubble Rubble with Chicken Dawg
 - What's your Exercise Personality?
 - Go From Couch to 5K in just 8 Weeks
- Physical activity recommendations:
<http://www.cdc.gov/physicalactivity/everyone/guidelines/children.html>
- Youth Online: View state data. Select a state, click "GO". Filter the data by selecting the Health Topic "Physical Activity." View the Table or Graph by selecting the appropriate tab.
<http://apps.nccd.cdc.gov/YouthOnline/App/Default.aspx>
- Rewards and benefits of exercise:
http://kidshealth.org/teen/food_fitness/exercise/exercise_wise.html#cat20133

Data analysis

Data set file:

Mobilize_ExerciseHealth_2011.csv

See **DataSet_Quest-Ans_Codes.doc** for survey questions and answer codes.

1. How many students report being active for 60 minutes on 5 or more of the past 7 days? What percent is this of the total number of students who responded?
2. Which students (age, gender) are most likely to get 8+ hours of sleep?
3. How is eating breakfast related to one's description of their weight?
4. Rank the popularity/frequency of the various physical activities?
5. Compare the frequency of playing video games with being active 60 minutes or more on 5+ of the past 7 days.

BIG idea questions

1. Does getting more sleep improve students' activity levels?
2. What exercise activities do teenagers engage in that are likely to be continued for more than 1 year?
3. How does a family's activity level impact the student's activity level?
4. What role do friends have in maintaining consistent activity levels?
5. How does participation in a sports team impact diet?
6. Are active students healthier than inactive students? Are they happier?

Topic 3: Teens, Social Media, and Online Behavior

Introductory Resources:

- Video Social Media Helps Teens See Other's Needs: <http://www.webpronews.com/social-media-teens-others-needs-2012-02>
- Social Media, Social Life – What Do Teens Think About Twitter And Facebook? [INFOGRAPHIC] http://www.mediabistro.com/alltwitter/social-media-teens_b24749
- Video Tagged (cyber bullying) Teens and Social Media <http://planningwithkids.com/2011/09/30/teens-and-social-media/> Includes teaching resources: <http://www.cybersmart.gov.au/tagged/teenagers.htm>
- An Analytical Take on Youth, Social Networking, and Web 2.0: A Few Moments with Amanda Lenhart <http://dmlcentral.net/newsletter/05/2012/analytical-take-youth-social-networking-and-web-20-few-moments-amanda-lenhart>
- [Teens, kindness and cruelty on social network sites: http://pewinternet.org/Reports/2011/Teens-and-social-media/Part-2/Section-1.aspx](http://pewinternet.org/Reports/2011/Teens-and-social-media/Part-2/Section-1.aspx)

Data analysis

Data set file:

Mobilize_MediaBehavior_2011.csv

See **DataSet_Quest-Ans_Codes.doc** for survey questions and answer codes.

1. Which privacy setting is most common?
2. What percentage of students has posted something they thought might reflect badly in the future?
3. What is the average number of text messages students send and receive?
4. Which gender has the most positive view of the kindness of others online?
5. How many students have been treated cruelly online?

BIG idea questions

1. What is the relationship between students who are most careful with their online presence and their kindness factor?
2. Are students who spend lots of time online more or less likely to join other organizations?
3. What is the relationship between the time spent online in social settings and time spent socializing offline?
4. What is the relationship between time spent on social media and academic success?
5. Which is more enduring, online relationships or physical relationships?
6. How important is honesty in online relationships? Are some online relationships more prone to honesty than others?

Topic 4: Teens, Video Games, and Civic Engagement

Introductory Resources:

- 22 Charts & Graphs on Video Games & Youth Violence
<http://videogames.procon.org/view.resource.php?resourceID=003627>
- How much do you know about video games <http://www.esrb.org/about/video-game-industry-statistics.jsp>
- Video game stats <http://www.onlineeducation.net/videogame>
- Video: [Do video games cause violence in kids? Interesting facts and data](#)
- <http://www.youtube.com/watch?v=vVjUr2zXtb4>

Data analysis

Data set file:

Mobilize_GamesCivic_2008.csv

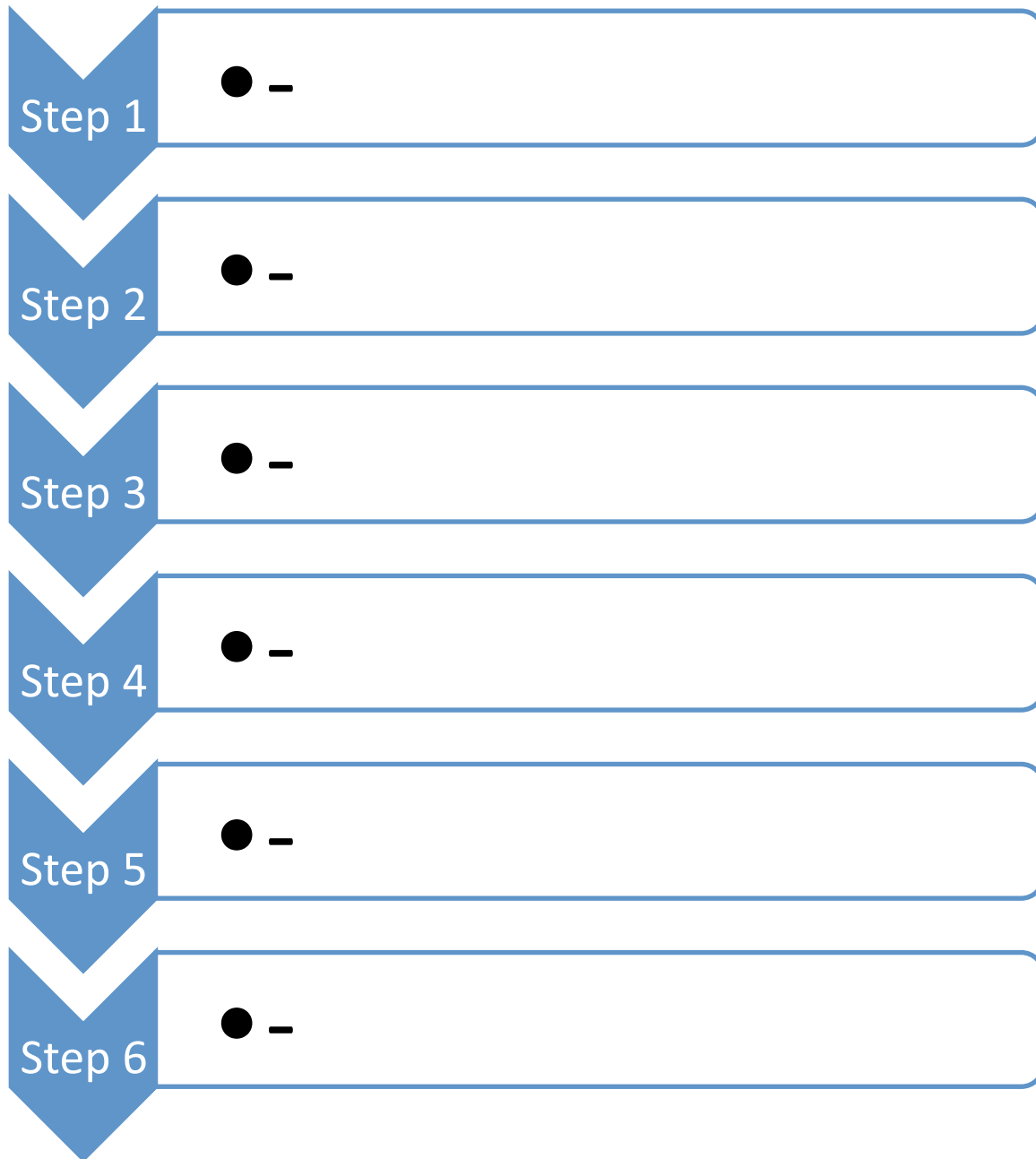
See **DataSet_Quest-Ans_Codes.doc** for survey questions and answer codes.

- 1 How many students engage in civic activities?
2. What percentage of students believe it is important to be at least somewhat involved in improving their community?
3. What is the most popular game type (fighting, puzzles, races, etc.)?
4. Create a word cloud of favorite games. What does this Word Cloud tell you about the popularity of games?
5. What is the relationship between the frequency someone plays games and how often he/she helps or guides others?

BIG idea questions

1. Are social-media-using students more or less socially aware of the needs of others?
2. Which social media venues foster the greatest tendency to get involved in charitable activities?
3. What types of games seem to promote more civic engagement?
4. How does parental involvement in the students' game playing influence the choice of games students play?
5. What is the relationship between accepting people from different backgrounds and playing video games?
6. What is the relationship between playing video games and crime or other anti-social behavior at school or in the community?

Survey Development Flow Chart



1. Ask a BIG question
2. Design a strategy (survey) to find the answer.
3. Write questions that will provide data to answer the question.
4. Collect data

5. Analyze the data
6. Tell the story or answer the BIG question using the data

Topic Selection Guide

Name _____

Use this guide to record your learning and ideas about the four topic choices for the Participatory Sensing Campaign. You will use the notes you record on this document to help select and plan the PS Campaign topic.

Topic #1 _____

List 3 things you learned from the data set and video or other introductory materials.

1. —
2. —
3. —

List 6 variables found in the data set for the research on this topic.

Additional notes:

List 3 things that you would like to know more about on this topic.

1. —
2. —
3. —

Topic #2 _____

List 3 things you learned from the data set and video or other introductory materials.

1. —
2. —
3. —

List 6 variables found in the data set for the research on this topic.

Additional notes:

List 3 things that you would like to know more about on this topic.

1. –
2. –
3. –

Topic #3 _____

List 3 things you learned from the data set and video or other introductory materials.

1. –
2. –
3. –

List 6 variables found in the data set for the research on this topic.

Additional notes:

List 3 things that you would like to know more about on this topic.

1. –
2. –
3. –

Topic #4 _____

List 3 things you learned from the data set and video or other introductory materials.

1. –
2. –
3. –

List 6 variables found in the data set for the research on this topic.

Additional notes:

List 3 things that you would like to know more about on this topic.

1. –
2. –

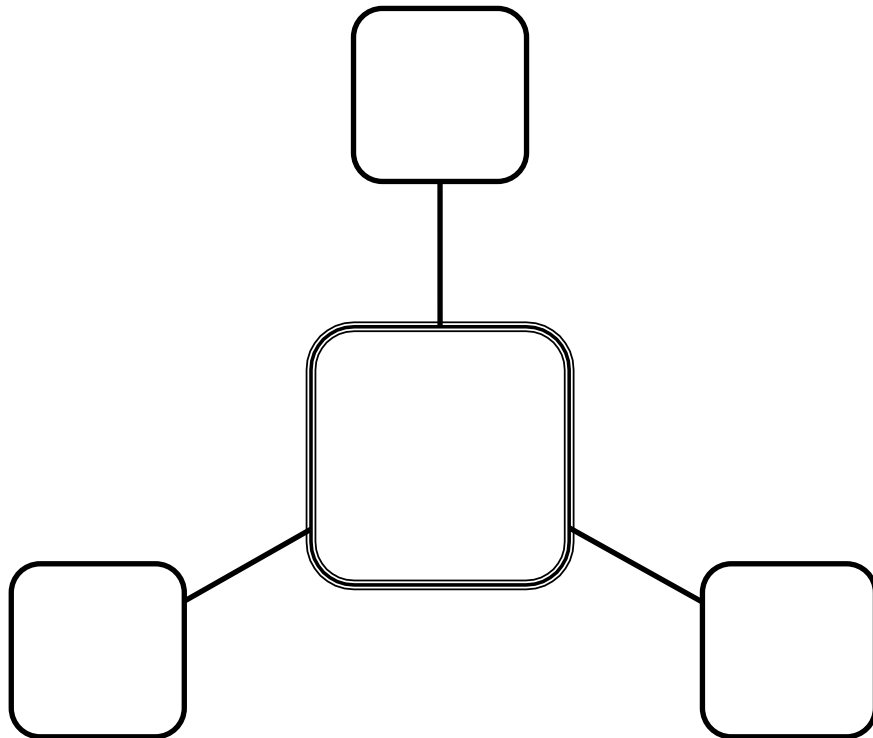
3. –

Participatory Sensing Campaign Kickoff

Team members

1. Recorder:
2. –
3. –
4. –

Add the topic for your Participatory Sensing Campaign in the center square. Add related concepts to the smaller squares. Add more shapes to add additional sub-concepts. Be sure to link/group related ideas.



BIG Question	Data Variables

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BIG Question Ideas:

Functional Role Cards for Computer Project Teams

Add additional tasks as needed for a project.

Rotate roles among team members periodically.

RECORDER and STORE KEEPER Write the groups ideas into planning documents. Keep track of planning documents. Record all ideas. Locate, collect, and distribute resources including informational resources. Coordinate efforts of the team members so that content and image resources are ready and available. Check progress against any due dates or timeline plans.	DESIGNER AND GUIDE Gather design ideas. Create or gathers images. Verify that design and content plans are followed. Check production against rubrics and project specifications.
DRIVER Create project content on the computer following the plans created by the team. Follow instructions of the designer and recorder/store keeper.	ENCOURAGER and SPY (This is an optional role if there is a 4 th team member) Check up on other groups. Bring good ideas back to the team.

Ask for assistance as needed.

Give ideas to other groups.