**Subject area/course**: Mathematics/Statistics

**Grade level/band**: 11-12

**Task source**: Summit Public Schools

**Data Collection**

**TEACHER'S GUIDE**

1. **Task overview**:

This project will introduce students to their first time writing a statistical analysis paper and collecting their own data.

First, students will practice sampling using a random number generator to understand

sampling methods and how to choose the best methods. Second, students will outline their study by creating (1) an introduction section that identifies the quantitative variable and population that will be studied, and (2) a methods section that precisely describes the data collection and sampling methods used in this study. Third, students will investigate biases and refine methods to limit the effect of bias on their own study. Fourth, students will carry out their revised study among a population of students and/or staff. Fifth, students will analyze the data collected and write up a final draft that demonstrates their ability to collect and analyze quantitative data. Relevant conclusions for the student population will be shared out and discussed in class as part of the final product.

1. **Aligned standards:**
2. **Primary Common Core State Standards**

#### [CCSS.MATH.PRACTICE.MP1](http://www.corestandards.org/Math/Practice/MP1/) Make sense of problems and persevere in solving them

#### [CCSS.MATH.PRACTICE.MP2](http://www.corestandards.org/Math/Practice/MP2/) Reason abstractly and quantitatively.

#### [CCSS.MATH.PRACTICE.MP3](http://www.corestandards.org/Math/Practice/MP3/) Construct viable arguments and critique the reasoning of others.

#### [CCSS.MATH.PRACTICE.MP5](http://www.corestandards.org/Math/Practice/MP5/) Use appropriate tools strategically.

#### [CCSS.MATH.PRACTICE.MP6](http://www.corestandards.org/Math/Practice/MP6/) Attend to precision.

[CCSS.MATH.CONTENT.HSS.ID.A.1](http://www.corestandards.org/Math/Content/HSS/ID/A/1/) Represent data with plots on the real number line (dot plots, histograms, and box plots).

[CCSS.MATH.CONTENT.HSS.IC.A.1](http://www.corestandards.org/Math/Content/HSS/IC/A/1/) Understand statistics as a process for making inferences about population parameters based on a random sample from that population.

[CCSS.MATH.CONTENT.HSS.IC.B.3](http://www.corestandards.org/Math/Content/HSS/IC/B/3/) Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each.

[CCSS.MATH.CONTENT.HSS.IC.B.4](http://www.corestandards.org/Math/Content/HSS/IC/B/4/) Use data from a sample survey to estimate a population mean or proportion; develop a margin of error through the use of simulation models for random sampling.

1. **Critical abilities**

Research (survey): Conduct sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, and demonstrate understanding of the subject under investigation. Gather relevant information from multiple authoritative print and digital sources, use advanced searches effectively, and assess the strengths and limitations of each source in terms of the specific task, purpose, and audience.

Analysis of Information (survey analysis):Integrate and synthesize multiple sources of information (e.g., texts, experiments, simulations) presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to address a question, make informed decisions, understand a process, phenomenon, or concept, and solve problems while evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

Experimentation and Evaluation (conducting the survey)**:** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text. Evaluate hypotheses, data, analysis, and conclusions, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

Communication in Many Forms (writing and graphical):Use oral and written communication skills to learn, evaluate, and express ideas for a range of tasks, purposes, and audiences. Develop and strengthen writing as needed by planning, revising, editing, and rewriting while considering the audience.

Use of Technology (spreadsheet):Present information, findings, and supporting evidence, making strategic use of digital media and visual displays to enhance understanding. Use technology, including the Internet, to research, produce, publish, and update individual or shared products in response to ongoing feedback, including new arguments or information.

1. **Time/schedule requirements:**

This task will take 2-3 weeks, depending on your school schedule and other activities. Below is a sample calendar showing the task’s steps and their approximate duration.

* Days 1-2 – Step 1. River Sampling Data Collection
* Days 3-5 – Step 2. Introduction and Methods Sections
* Day 6 – Step 3. Investigate Bias and Refine Methods
* Days 7-9 – Step 4. Collect Data
* Days 10-11 – Step 5. Rough Draft & Peer Review
* Day 13. Final Draft Due

1. **Materials/resources:**

* Item A. River Farm Sampling Document [Step 1]
* Item B. Introduction and Methods Overview [Step 2]
* Item C. Support Document 1 – Introduction [Step 2]
* Item D. Support Document 2 – Population Sample [Step 2]
* Item E. Support Document 3 – Methods Section [Step 2]
* Item F. Making Revisions to Limit Bias [Step 3]
* Item G. Support Document 4 – Analyzing Data [Step 5]
* Item H. Support Document 5 – Discussion Section [Step 5]
* Item I. Support Document 6 – Acknowledgements, Abstract, Appendix [Step 5]
* Item J. Data Collection Peer Review Checklist [Step 5]

1. **Prior knowledge:**

None listed.

1. **Connection to curriculum:**

None listed.

1. **Teacher instructions:**

* Step 1. Students will practice sampling using a random number generator to understand sampling methods and how to choose the best methods.
* Step 2. Students will outline their study by creating (1) an introduction section that identifies the quantitative variable and population that will be studied, and (2) a methods section that precisely describes the data collection and sampling methods used in this study.
  + It may help to remind students of the examples of quantitative variables listed below.
  + Good examples of quantitative variables:
    - Number of minutes spent on Facebook every week
    - Hand span in centimeters
    - Time it takes to complete a task in seconds
    - Number of pairs of shoes owned
  + Bad examples of quantitative variables *(these are categorical)*
    - Zip codes
    - Phone numbers
    - Gender
    - Favorite color
    - Political party
    - Opinion on a question (yes/no/maybe)
* Step 3. Students will investigate biases and refine methods to limit the effect of bias on their own study.
* Step 4. Students will carry out their revised study among a population of students and/or staff. Students may want to use a Google spreadsheet or an Excel document to organize their data.
* Step 5. Students will analyze the data collected and write up a paper that demonstrates their ability to collect and analyze quantitative data.
  + Students should use the Peer Review Checklist (Item J) to review one another’s work.
  + After receiving feedback from peers and taking time to revise their papers, students will turn in a final draft of their paper.

1. **Student support:**

**Tips for the Support Document 1 for students who need additional suppor**t:

1. What websites did you visit most recently? What topics are you studying in other classes that interest you? What do you wish you knew about people at your school or in your neighborhood?
2. This would be a number that you could know about someone or something. For example, the number of Instagram followers people have, or the number of content assessments they have attempted, or the number of words in a song’s lyrics, or the number of hours of sleep people get per night, or the number of grams of fat in the school lunches.
3. Underline each sentence that applies to your variable.
4. Think about your variable. Who or what is the biggest group that would have that variable in common? For example, the number of Instagram followers might be common among all Bay Area high school students (or maybe all of California?), but the number of content assessments would only be common throughout your public schools district (or maybe only your own school?).
5. Underline each sentence that applies to your population.
6. Who or what can you easily sample? For example, my population may be all high school students in the state, but my sampling frame could be students at my school.
7. Is there any previous research or other ideas that you can use to improve your guess? Put a little bit of thought into this (it should be reasonable), but not too much (you’ll be doing better than guessing later in the project).
8. Write the answers to each bullet point briefly here so that you have a quick summary.
9. Start with your topic and population why it interests you or why it deserves to be studied. Then, instead of just announcing your variables, you may want to phrase them as questions. Include any relevant background information and/or your predictions.

**Tips for the Support Document 3 for students who need additional support**:

1. *A simple random sample (SRS) is usually adequate for most situations. If you decide to use a stratified sample, cluster sample, or some other method, make sure you have adequate justification. When you are describing your process, it should be step-by-step and specific enough that a reader could follow the exact same process.*
2. *Remember that bias is when your sample is systematically not representative of your population. Be specific about the kind of potential bias, and name it. The kinds of bias that are most frequently present in a sampling method are undercoverage and nonresponse.*
3. *When you are describing your process, it should be step-by-step and specific enough that a reader could follow the exact same process. This about how to be precise and minimize human error.*
4. *Remember that bias is when your data is systematically not representative of your population. Be specific about the kind of potential bias, and how it would affect your data. The kind of bias that is most frequently present in a data collection method is response bias.*

**Tips for the Support Document 5 for students who need additional support:**

1. *Think especially about human error (like typos when entering data or mistakes when measuring data). Remember that random error is reflected in the size of your margin of error and the size of your confidence interval.*
2. *If some bias entered into your sampling method, you may only be able to generalize to a smaller population. Almost every study can be generalized to some extent beyond the sample… justify your population to be as big as is reasonable!*
3. *You might not have needed to make revisions to anything, but if you did, you should mention it here.*

**Tips for the Final Support Document for students who need additional support:**

1. *Tip: If you collected data from people, respect their privacy! They should remain anonymous. You can thank them as a group, but not by name.*
2. *Tip: Your Appendix should be included at the bottom of your paper (NOT as a google spreadsheet) as long as it is less than 2 pages long. Make sure each column is clearly labeled. It should include the information you used for both your means and your proportions question.*
3. *Tip: If someone is pressed for time, they should be able to read just your abstract and get the gist of the entire paper… including your most important results! It goes at the very beginning but is the last thing you should write.*
4. **Extensions or variations:**

None listed.

1. **Scoring:**

Student work can be scored using the Summit Public Schools Data Collection Rubric.