Literacy Design Collaborative

Student-Determined Data Analysis

★ TASK ★ LADDER

by Dorothy Sutton, Kelly M. Gaier Evans, and Peter DeWitt

Adapted from "Battelle Data Analysis Module Template" by Kelly M. Gaier Evans and Peter DeWitt

This module has been developed from the Battelle Data Analysis Module Template and adapted for Metro Early College High School students in Learning Centers (Bodies [biomedical], Digital [music], Design [engineering], and Growth [agriculture]). These are advanced students and mostly juniors. Students will have the freedom in choice of topics and research questions within the content of their Learning Center (i.e., biomedical, music, engineering, agriculture). This is the first unit of the year for the students in the Scientific Writing and Research Course. Students may either pick a topic or be assigned a topic by the teacher. In this module, students have the opportunity to formulate their own research questions based on their interests.

Scientific Writing and Research is a course that aims to help students succeed as future leaders in STEM fields through effective literacy skills. This LDC module, therefore, aims to increase students' abilities in reading, writing, listening, and speaking within STEM fields. Data analysis and the ability to read with and work with data are paramount in each of the four fields available for students entering learning centers. The summative assessment for this module takes the shape of a data analysis report and presentation, so the entire unit is addressed within this single module.

Data (evidence) analysis and interpretation are central to the basic scientific process of asking questions, carrying out testing, gathering data, analyzing data, and reporting on that analysis. Often, we ask students to carry out meaningful scientific studies, not realizing that they are not sufficiently experienced with data analysis. The Battelle Data Analysis Module Template isolates the data selection, analysis, and reporting process in order to further develop data fluency in science students. This data analysis template asks students to utilize "secondary data"—data sets that already exist and were gathered by someone else. Using pre-existing data temporarily removes the "experimentation" stage of the scientific process in order to focus student learning on how to choose data that can answer a scientific question and how to interpret and present that data.

The Battelle Data Analysis Template is designed to be the first of a three-part Battelle LDC Science Collection: Data Analysis, Controlled Experimentation, and Design. The series represents a continuum of skills that build upon each other. It is advisable that students be relatively fluent in experimentation prior to completing the design module—and relatively fluent in data analysis before completing a Battelle Controlled Experiment Module. For this module, the Battelle Data Analysis Template was modified specifically for an ELA Scientific Writing course in a STEM school.

We thank Jared Schuetter (Statistician at Battelle) for his assistance in sharing his work processes and providing real world examples to include in this module.

GRADES	DISCIPLINE	COURSE	PACING
11 - 12	**ELA**	**Scientific Writing and Documentation**	**N/A**

Section 1: What Task?

Teaching Task

Task Template A4 - Argumentation

After researching available scientific articles about your chosen research topic/question, write a data analysis report in which you argue your findings using the publicly-available data. Support your position with evidence from the text/s. Be sure to acknowledge competing views. Identify any gaps or unanswered questions. Include in-text citations and a bibliography in APA format. Include charts, tables, and/or graphs to help convey your message to your readers. Connect the dependent variable(s) and independent variable(s) in your response. Give at least three example/s from past or current events to illustrate and clarify your position.

Standards

Common Core State Standards for English Language Arts & Literacy in History/Social Studies, Science, and Technical Subjects

RI.11-12.1

Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

RST.11-12.7

Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RST.11-12.9 Focus

Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

WHST.11-12.8 Focus

Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and over-reliance on any one source and following a standard format for citation.

WHST.11-12.9

Draw evidence from informational texts to support analysis, reflection, and research.

SL.11-12.4

Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.

WHST.11-12.1 Focus

Write arguments focused on discipline-specific content.

WHST.11-12.7

Focus

Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Ohio's New Learning Standards: Mathematics

CCSS.Math.Content.7.SP.A

Focus

Use random sampling to draw inferences about a population.

CCSS.Math.Content.HSS-ID.A

Summarize, represent, and interpret data on a single count or measurement variable

CCSS.Math.Content.HSS-ID.B

Summarize, represent, and interpret data on two categorical and quantitative variables

CCSS.Math.Content.HSS-ID.C

Interpret linear models

Texts

Text resources.docx

Student Work Rubric - Argumentation Task - Grades 9-12

	Emerging	Approaches Expectations	Meets Expectations	Advanced
	1	2	3	4
Controlling Idea	Makes a general claim with an unclear focus.	Establishes a **clear** claim **that addresses the prompt**, with an **uneven focus**.	Establishes **and maintains** a **clear, specific, and credible claim** that addresses **all aspects** of the prompt.	Establishes and maintains a **precise, substantive** claim that addresses all aspects of the prompt. **Acknowledges limitations and/or the complexity of the issue or topic**.
Selection & Citation of Evidence	Includes minimal details from sources. Sources are used without citation.	Includes **details, examples, and/or quotations** from sources that are **relevant to the claim**. **Inconsistently** cites sources.	Includes details, examples, and/or quotations from sources that **support** the claim and **supporting ideas**. **Consistently** cites sources **with minor formatting errors**.	Includes **well-chosen** details, examples, and/or quotations from sources that **fully support** the claim and supporting ideas. Consistently cites sources **using appropriate format**.
Development / Explanation of Sources	Explanation of ideas and source material is irrelevant, incomplete, or inaccurate.	Explains ideas and source material **to support the argument**, with **some incomplete reasoning or explanations**.	**Accurately** explains ideas and source material and **how they support** the argument.	**Thoroughly** and accurately explains ideas and source material, **using logical reasoning to support and develop** the argument.
Organization	Lacks an evident structure. Makes unclear connections among claims, reasons, and/or evidence.	**Groups ideas and uses transitions** to develop the argument, with **some lapses in coherence or organization**.	**Groups and sequences** ideas to **develop a cohesive argument**. Uses transitions **to clarify the relationships among claim(s), reasons, and evidence**.	Groups and sequences ideas **in a logical progression in which ideas build to create a unified whole**. Uses **varied** transitions to clarify the **precise** relationships among claim(s), reasons, and evidence.
Conventions	Major errors in standard English conventions interfere with the clarity of the writing. Language or tone is inappropriate.	Errors in standard English conventions **sometimes interfere** with the clarity of the writing. Uses language and tone that are **sometimes inappropriate** for the audience and purpose.	**Consistently applies** standard English conventions; **minor errors**, while noticeable, **do not interfere** with the clarity of the writing. Uses language and tone **appropriate to the audience and purpose**.	Consistently applies standard English conventions, **with few errors**. Demonstrates **varied syntax** and **precise word choice**. **Consistently** uses language and tone appropriate to the audience and purpose.
Content Understanding (Generic)	Attempts to include disciplinary content in explanation or argument but understanding of content is weak; content is irrelevant, inappropriate, or inaccurate.	Briefly notes disciplinary content relevant to the prompt; shows basic or uneven understanding of content; minor errors in explanation.	Accurately presents disciplinary content relevant to the prompt with sufficient explanations that demonstrate understanding.	Integrates relevant and accurate disciplinary content with thorough explanations that demonstrate in-depth understanding.

Background for Students

How do medical professionals/musicians/engineers/agriculture professionals use data?

In all areas of studies, it is important to understand and be literate in data. Data can help us form decisions in many areas of our lives that we do not recognize and answer questions that books and peers cannot. Data can be used in powerful ways to inform, to influence, and to make meaning.

This module aims to guide you in exploring data to answer a research question of your own design within a group. Throughout this project, you will learn how to draft a research question, locate a data source, analyze the data, and create a data analysis report and presentation, all while working on an area that interests you and your group.

Extension

After students write the data analysis report on a self-selected research topic/question, students are asked to design and make a presentation for their classmates about their data analysis question.

Section 2: What Skills?

Preparing for the Task

TASK ANALYSIS: Ability to review task and identify goals, benchmarks, and deliverables.

TASK ENGAGEMENT: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.

USING DATA TO MAKE A DECISION: Ability to use data to answer a question.

CHOOSING A RESEARCH QUESTION TO INVESTIGATE AND ANSWER: Ability to analyze possible research questions and choose one to investigate based on interest and feasibility of answering it.

Clarifying Research Question

RESTATING THE QUESTION: Ability to restate the question in their own words . . . "so, what we are trying to answer is _____."

COMPARING CITATION SYSTEMS: Ability to identify features of common citation systems and explain how and why they differ.

INSPECTIONAL READING: Ability to examine a scientific text and list the sections that organize the text.

TEXT SELECTION: Ability to find relevant texts and create annotated bibliography entries.

BACKGROUND RESEARCH: Ability to develop a working knowledge of the existing body of knowledge that has been previously written about a research question.

IDENTIFYING VARIABLES PRESENT IN A RESEARCH QUESTION: Ability to deconstruct a research question, based on background research, into possible variables.

CONCEPTUALIZING THE POTENTIAL RELATIONSHIPS BETWEEN VARIABLES: Ability to identify the potential of simple cause-effect relationships and/or more complex non-linear relationships among variables in a research question.

DEVELOP A HYPOTHESIS: Ability to articulate an expected relationship between two or more variables.

SOLIDIFYING A DATA ANALYSIS PLAN: Ability to clearly link hypothesis to data and data analysis.

Selecting a Data Set

RESEARCHING HOW OTHERS HAVE ATTEMPTED TO ANSWER SIMILAR QUESTIONS: Ability to analyze how other researchers have previously addressed a similar research question.

LOCATING DATA SOURCES THROUGH THE REFERENCES OF OTHER TEXTS: Ability to use similar research reports as a spring board to finding potentially appropriate data sources.

ANALYZING DATA: VARIABLES: Ability to analyze data sources for inclusion of variables identified in one's hypothesis.

ANALYZING DATA: QUALITY: Ability to research methods used to gather data in order to identify potential problems / shortcomings of data: bias, lack of completeness, unreliable collection methods, etc.

COMPILING A FINAL DATA SET: Ability to select one or more appropriate final data sets to analyze based on the sample, completeness, variables, and potentials issues of the data sets.

Interpreting Data

DEFINING DATA RELATIONSHIPS: Ability to analyze and identify any clear (or unclear) relationship between the variables based on the data.

DRAWING CONCLUSIONS FROM DATA: Ability to build a persuasive, data-based case that clearly states the relationship between variables in a data set.

STATING FINDINGS IN CONTEXT OF EXISTING BODY OF KNOWLEDGE: Ability to relate how data findings contribute to the overall body of knowledge about a research topic.

IDENTIFYING DATA ANALYSIS LIMITATIONS: Ability to identify and articulate known weaknesses in the data analysis (e.g., small sample size, highly variable data, assumptions in interpretation, etc.)

Writing and Presenting a Data Analysis Report

WRITING THE BACKGROUND SECTION: Ability to clarify a question being studied, explain how other researchers have attempted to answer that question, and provide the rationale for the selection of the data set(s) being used in the current analysis.

WRITING THE DATA SECTION: Ability to represent data in both figures and text.

WRITING THE CONCLUSIONS SECTION: Ability to communicate conclusions that were drawn based on the data, how those conclusions are similar or different to the conclusions others have drawn, and how those conclusions may be limited.

WRITING AN EXECUTIVE SUMMARY: Ability to summarize findings in a succinct, clear, and accurate manner.

Section 3: What Instruction?

PACING	SKILL AND DEFINITION	PRODUCT AND PROMPT	SCORING GUIDE	INSTRUCTIONAL STRATEGIES
Preparing for the Task				
20 mins	**TASK ANALYSIS**: Ability to review task and identify goals, benchmarks, and deliverables.	**DATA ANALYSIS—UNIT OVERVIEW AND ANALYSIS** You will receive a PDF overview of the first unit, Data Analysis. Read the overview (knowing that this project will last many weeks, don't panic) and annotate the PDF with questions and comments. What will you need to do? What vocabulary is unfamiliar? What is the pacing of the unit? What is the product?	A mastery-level student product will ● Be annotated with questions and comments ● Answer the questions from the prompt.	1. Distribute copies of this lesson in PDF format. 2. Instruct students on annotating the packet.
	Additional Attachments: **Task Analysis and overview.pdf**			
30 mins	**TASK ENGAGEMENT**: Ability to connect the task and new content to existing knowledge, skills, experiences, interests, and concerns.	**DATA ANALYSIS—TASK QUESTIONNAIRE** Based on your reading of the task, develop three questions that need to be answered so that you can successfully meet the goals of the task. Then decide on the most important question, and share this question with the class. Finally, after listening to your peers share their questions, participate in a class discussion to select the five most important questions that should be addressed when responding to the task.	Meets expectations if student product: ● Develops questions based on the task ● Explains each question thoroughly.	**Note**: A handout (**Questioning the Task** under Student Handouts below) has been attached to help students organize their work for this mini-task. You may want to type the task in the box provided on the handout. **Instruction**: 1. Provide students with a sample task and model how to pose three to four questions that need to be answered to achieve the goal of the task. After you brainstorm the questions, think aloud about how to decide which question is the most important. If your students need additional modeling for writing questions, post three to five question stems on the board (see the **Question Stems** link under Teacher Resources for more ideas). 2. Give students the **Questioning the Task** handout and read through the task with them the first time. 3. Then, pose a question that needs to be answered to achieve the goal of the task. 4. Give students two or three minutes to come up with two other questions that would need to be answered to achieve the goal of the task.

				5. Ask them to look at the two questions they came up with and to circle the one that they think is the most important. 6. Give them two to three minutes to get this question written on the board. If you don't have a large area of board space, you could hang a large piece of paper on the wall and have students write their questions on the paper using markers. Another option is to project a Powerpoint slide or Word document and ask students to take turns typing in their responses. 7. In groups of four, have students discuss all the questions on the board and decide which five they think are the most important. 8. Have each group share its top five questions. After all of the questions have been shared, ask the class to agree on the five most important questions. 9. When the discussion is finished and the top five questions have been selected, write the questions on a large piece of paper and post them on the wall. Keep this paper up on the wall as a guide throughout the module.
	Standards: **CCR.W.4** : Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **CCR.R.1** : Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. **CCR.SL.1** : Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.			
	Additional Attachments: **Question Stems** **Questioning the Task.docx**			
30 mins	**USING DATA TO MAKE A DECISION**: Ability to use data to answer a question.	**DATA ANALYSIS—CHALK TALK (LUNCH OPTIONS)** Of those offered, decide which option you would prefer to eat for lunch. List information/data you find on the options. Support your decision with the data. Describe the importance of the data in your decision.	A mastery-level student response should: • Include information/data found on the options • Use data to defend their decision • Explain the importance of the data.	Chalk talk/walk 1. Teacher displays (on white board, large sticky notes, etc.) three to five lunch options around the room. 1. McDonald's Big Mac, medium french fries, medium Coca-Cola 2. Wendy's spicy chicken Caesar full-sized salad, medium Coca-Cola 3. Chipotle chicken burrito with white rice, black beans, tomato salsa, sour cream, and cheese; medium Coca-Cola 4. Little Ceaser's cheese pizza (three slices [nutritional information is based on one slice]), medium Coca-Cola 5. Jimmy John's Turkey Tom with lettuce, tomato, and mayonnaise; regular Jimmy chips; regular Coca-Cola 2. In groups of three to five, students research data to add to the displays for three to four minutes at each station. Students may add cost, calories,

				nutrients, availability/location, etc. 3. After students have visited each station, each group must agree on the best lunch option based on the research. Students agree on the data/information that influenced their decision. 4. Students share their decisions and supporting data. Students explain why data analysis is important.

Standards:

RST.11-12.8 : Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11-12.7 : Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.

RI.11-12.7 : Integrate and evaluate multiple sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a question or solve a problem.

RI.11-12.1 : Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

Additional Attachments:

Jimmy John's Menu

Little Ceaser's Pizza Nutritional Information

Chipotle nutritional information

Wendy's meal builder

Big Mac meal summary

30 mins	**CHOOSING A RESEARCH QUESTION TO INVESTIGATE AND ANSWER**: Ability to analyze possible research questions and choose one to investigate based on interest and feasibility of answering it.	**DATA ANALYSIS—RESEARCH QUESTION DRAFT** List your top three to five areas of interest related to your learning center. If you are having trouble identifying your interest, think about why you joined this learning center as opposed to another one. Find groups of four to five with similar areas of interest. As a group, draft a research question to answer (this may be vague). Include dependent and possible independent variables.	A mastery-level student product should: ● Include an area of focus (for example, diabetes, GMOs, online music sales, 3D printing, etc.) ● Include one independent variable ● Include at least one or more dependent variables.	1. Students list top three to five areas of interest related to the learning center (for example, pediatrics, diabetic treatment, geriatrics, neuroscience, etc.). Students form groups of four to five based on areas of interest (like interests together). 2. Students brainstorm potential research questions, the independent variable, and one or more dependent variable(s). 3. Students form a general research question to answer (for example, "Are there pathways that lead to diabetes?" or "Are GMOs more productive than organic crops?"). 4. Teacher must confirm the availability of data on the question before students move forward.
Clarifying Research Question				
20 mins	**RESTATING THE QUESTION**: Ability to restate the question in their own words . . . "so, what we are trying to answer is	**DATA ANALYSIS—RESTATED, REVISED RESEARCH QUESTION** Write a copy of your research question to be answered. Restate the	A mastery-level student product: ● Will have been read and signed by two appropriate readers ● Will include	1. After students draft their research question to be answered, they record it on the attached worksheet. 2. As homework, students must have two trusted readers question and comment on the research question to answer. Students should

	_____."	question as outlined on the worksheet ("What we are trying to find/answer is..."). Ask two trusted readers (a parent/guardian, peer, sibling, etc.) to review the research question, comment on it, ask clarifying questions, and sign your worksheet. Record the comments and questions. Revise your research question as necessary.	questions and comments from the readers • Will include any necessary revisions.	revise their work based on the comments and questions before the next class meeting.
	Additional Attachments: **Experimental Question restate and revise.docx**			
50 mins	**COMPARING CITATION SYSTEMS**: Ability to identify features of common citation systems and explain how and why they differ.	**COMPARISON OF CITATION SYSTEMS** Analyze the citation systems representing three major fields of study to determine how each system represents the values of the fields that use it.	A student response meets expectations if it does the following: • Articulates the visible differences between citation systems • Provides an explanation for how the differences correlate with the values of the disciplines that use that citation system.	**Direct Instruction:** 1. Give students Citation Comparison Chart handout. 2. Explain how we are going to look at three different systems for citing evidence when writing a research paper. 3. Give students the full name for each system: ◦ Modern Language Association ◦ American Psychological Association ◦ Institute of Electrical and Electronic Engineers 4. Lead group in a discussion of which system they would use in different classes. Examples: MLA (English); APA (science); IEEE (computers). 5. Show students the "Sample In-Text Citation Comparison Chart" and ask them to point out differences within the citations listed. • When a table such as this is shown to students, one of the first things they notice is the inclusion of publication date in APA format but no publication date in MLA format. This difference is important. In the social sciences, when an article was published is significant. A study on cancer cells from 1956 may not be as relevant as a study on cancer cells from 2012. Thus, whenever evidence in the form of citation is introduced in an APA-style paper, the date is included to alert the reader to the timeliness of the piece. In MLA, which is commonly used in the humanities, timeliness isn't as important. For example, a literary interpretation of *Hamlet* from 1972 is just as relevant and significant as one from 2011. Students should also point out that in IEEE, no page number is included at all. The lack of included page numbers points out how rare direct quotation is in these disciplines. • Students also point out that IEEE doesn't show the author at all. This demonstrates that in IEEE disciplines authorship is significantly less valued

than the data itself. This differs significantly from MLA or APA, where "who" said something can be just as important, if not more important, than "what" was said.

6. Show students the "Sample Works Cited or References Comparison Chart." Once again, ask them to point out the differences between the three citation systems and invite them to consider why these differences might arise.

7. There are two major differences that students should note:

- The first is that in MLA, an author's full first name is given whereas in APA, only the first initial is listed. The lack of full first name in APA indicates that disciplines employing APA as a citation style tend to favor the data (the methods, results, and discussion) over individual authorship. In MLA disciplines, authorship is very significant, in part because these disciplines tend to be data-driven, meaning that theories and abstractions tend to be associated with individuals rather than with disciplines as a whole. Student will also once again note the placement of publication date.
- A final difference of interest is the way that IEEE style citation uses numbers to order citations rather than alphabetically-listed last names. When using IEEE, citations appear in the reference list in the same order they appear in the text itself. Disciplines that use IEEE tend to value concision and efficiency. By numbering their citations, IEEE writers can include less information in the text itself and numerically refer the reader to the reference page.

8. Wrap up discussion by reminding students that citation is not arbitrary, and that the information included in citations, and the way those citations are presented, represent critical ways that disciplines and professions make knowledge.

Extension:

Have students collect examples of writing from their different classes and bring them to your class. Have students exchange writings and try to identify which classes they are from based on evidence from their citation systems.

Standards:

CCR.L.3 : Apply knowledge of language to understand how language functions in different contexts, to make effective choices for meaning or style, and to comprehend more fully when reading or listening.

Additional Attachments:

Sample In-Text Citation Comparison Chart

Sample Works Cited or References Comparison Chart

	Citation_Comparison_Chart			
30 mins	**INSPECTIONAL READING**: Ability to examine a scientific text and list the sections that organize the text.	**DATA ANALYSIS—NOTES ON SCIENTIFIC ARTICLES** 1. Using teacher-selected peer-reviewed articles, identify the major sections of a scientific article and what each section does. 2. Participate in exercise on searching peer-reviewed articles and creating annotated bibliography entries. • What makes an article "good" or useful? • What is the importance of the abstract? • How do you evaluate an article?	Mastery-level student work should: • Identify the following in a scientific article: abstract, introduction, background, methods/materials, results, conclusions, bibliography. • Understand the following components of an annotated bibliography entry: citation, summary, evaluation, reflection.	1. Distribute teacher-selected text to students. 2. Ask students to list the most important parts of the text and what each part does. 3. In groups of three to four, students should share what they found, then share with the class. Each group should have identified the following: abstract, introduction, background, methods/materials, results, conclusions, bibliography.
	Standards: **RST.11-12.9** : Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **RST.11-12.8** : Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **RST.11-12.7** : Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. **RST.11-12.6** : Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved. **RST.11-12.2** : Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.			
	Additional Attachments: **pipeline persistance article.pdf** **first year STEM students article.pdf**			
1 hr	**TEXT SELECTION**: Ability to find relevant texts and create annotated bibliography entries.	**DATA ANALYSIS—ANNOTATED BIBLIOGRAPHY ENTRY** Read and annotate teacher-selected article and draft an annotated bibliography entry.	A mastery-level student product will: • Include a complete annotated bibliography entry from the teacher-selected text.	• Give demonstration on how to search for peer-reviewed articles on OSU's database using a student area of focus. • Demonstrate how to skim an article, decide if it is worth downloading, read and annotate the article, and draft an annotated bibliography entry. • Allow students time to read and annotate the teacher-selected text and create an annotated bibliography entry.
	Standards: **WHST.11-12.9** : Draw evidence from informational texts to support analysis, reflection, and research. **WHST.11-12.8** : Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and over-reliance on any one source and following a standard format			

	for citation. **WHST.11-12.7** : Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **WHST.11-12.4** : Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **WHST.11-12.2** : Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes. **RST.11-12.8** : Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. **RST.11-12.5** : Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas. **RST.11-12.2** : Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.			
1 hr and 30 mins	**TEXT SELECTION**: Ability to find relevant texts and create annotated bibliography entries.	**DATA ANALYSIS—INDEPENDENT ANNOTATED BIBLIOGRAPHY ENTRIES** • Find three peer-reviewed articles that address your experimental question to answer. • Read and annotate the articles, create an annotated bibliography entry for each article.	A mastery-level student response will: • Provide three annotated bibliography entries based on the three articles • Include all necessary bibliographic information.	Guide students on selection of three articles.
1 hr	**BACKGROUND RESEARCH**: Ability to develop a working knowledge of the existing body of knowledge that has been previously written about a research question.	**CLOSE READING OF SCIENTIFIC TEXTS USING THE GIST METHOD** Using your previously identified sources, use the GIST method and graphic organizer to summarize the articles.	A mastery-level student response will: • Have complete, accurate responses for all portions of the GIST strategy graphic organizer for each article • Include an explanation for the main idea of the resources used and how each can help students complete their scientific research paper.	**Note to teacher:** There are several variations to the GIST method. Attached under the Teacher Resources is an overview to the method used in this lesson as well as additional graphic organizers varying in level of depth and aesthetics. **Instruction:** 1. Provide students with digital or hard copies of the GIST strategy graphic organizer. 2. Go over the graphic organizer explaining that they will be looking for the major details in the text (the 5 W's and H) and provide a short, 20-word summary of the text. This will allow them to write down any important facts and summarize the article so they can refer back to it later. 3. Use a previous article to model the GIST method for the class. 4. Let students know that while direct quotations are not required, they can insert direct quotes they may want to use directly on the graphic organizer. Remind them to keep track of any page numbers they used. 5. Allow students to start working on filling out graphic organizers for previously found articles. Check in with teacher after each article to enable redirection and teaching if needed to individuals.
	Standards:			

CCR.R.2 : Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.

RST.6-8.2 : Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.

Additional Attachments:

GIST Strategy Overview and Addt'l Graphic Organizers.pdf

GIST Summarization Template.pdf

30 mins	**IDENTIFYING VARIABLES PRESENT IN A RESEARCH QUESTION**: Ability to deconstruct a research question, based on background research, into possible variables.	**DATA ANALYSIS—IDENTIFICATION OF VARIABLES** Using your annotations from the scientific articles you read, identify what pieces/variables are available to answer your research question. Write each variable on a sticky note with a citation of the article where you found it. As a group, arrange the sticky notes in similar groups. Consider what is not explicitly stated within your group's sticky notes, but could affect data. Add these gaps on a different color of sticky note. For example, location, time, age, race, gender, diet, etc.	A mastery-level student response will: • Identify variables on separate sticky notes • Include a citation on each sticky note • Show agreement upon the variables as a group • Have notes meaningfully grouped • Identify any gaps and identify them on different color sticky notes.	**Notes:** 1. Distribute two colors of sticky notes. 2. Before asking your students to complete this task, you may want to model it. Model the process of selecting variables, writing them on sticky notes with citations, grouping these sticky notes, and writing other sticky notes with unstated variables that might affect data. **Student process:** 1. Students should individually use annotated articles to identify possible variables. 2. As a group, students should write each variable on a separate sticky note. For example, if your group is focusing on what variables capture lifestyle choices that may lead to diabetes, variables from the articles might be diet, exercise, etc. Encourage students to debate and come to consensus on disagreements. 3. Student groups write the corresponding citation on the sticky note. 4. Student groups arrange the sticky notes into meaningful groups. 5. Circulate and check student work. 6. On the other colored sticky notes, student groups should identify unstated variables that could affect the data. They should consider what is not explicitly stated within their group's sticky notes, but could affect data. Add these gaps on different color sticky notes. For example, location, time, age, race, gender, diet, etc.

Standards:

RST.11-12.9 : Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.

RST.11-12.8 : Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information.

RST.11-12.1 : Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Additional Attachments:

VIDEO: LDC Data Analysis: Identifying Variables

30 mins	**CONCEPTUALIZING THE POTENTIAL RELATIONSHIPS BETWEEN VARIABLES**: Ability to identify the potential of simple cause-effect relationships and/or more complex non-linear relationships among variables in a research question.	**DATA ANALYSIS—CONCEPT MAP OF VARIABLES** Using the sticky notes you created and a giant sticky note or white board, arrange the variables of your experimental question according to relationships. For example, if financial stability is the biggest contributor to success for a first-year college student, illustrate that relationship on the giant sticky note or white board. You can do this with different colors, using words or images, in whatever way makes sense to your group. See the teacher's example if you need more help.	A mastery-level student response should: • Have citations organized in meaningful groups • Explain the relationships between variables and the research question • Explain the relationships among variables.	**Notes:** 1. This mini-task builds on the "Identifying Variables" mini-task. 2. Before asking your students to complete this task, you may want to model it. 3. This task may result in students coming up with new questions about the relationship between variables. These questions may not have been addressed in the research they read. Encourage them to make note of these new questions. **Student process:** 1. After students create meaningful groups for their citations, they need to identify the relationships between the variables and their effects on the research question. 2. Students should arrange their small sticky notes in a visual way to create a concept map of the relationships. 3. Students should outline these relationships so any passer-by could understand the message. 4. Use the attached "arrange variables example" PDF to guide students who are struggling. In this example, the student organized their variables into several groups that impact student success during their first year of college. Next, they analyzed the relationship between the variables.
	Standards: **RST.11-12.9** : Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible. **RST.11-12.7** : Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.			
	Additional Attachments: **arrange variables example.pdf** **VIDEO: LDC Data Analysis: Identifying Variables**			
20 mins	**DEVELOP A HYPOTHESIS**: Ability to articulate an expected relationship between two or more variables.	**DATA ANALYSIS—HYPOTHESIS DRAFT** Based on the concept map your group created with your experimental question and citations, develop a hypothesis between two or more variables that addresses your experimental question. For example, based on the concept map for first-year college student success, one possible hypothesis could be "The most successful first-year college students have	A mastery-level student response should: • Articulate an expected relationship • Include two or more variables • Address the research question.	This mini-task builds upon the "Data Analysis—Concept Map of Variables" mini-task. Students should use their concept maps to draft a hypothesis that articulates the expected relationship between at least two of the variables and the research question. Teacher should circulate and help students draft their hypothesis. Teacher should also confirm that there is a viable data set for students to examine.

		strong familial support and spend at least 10 hours studying each week."		
20 mins	**SOLIDIFYING A DATA ANALYSIS PLAN**: Ability to clearly link hypothesis to data and data analysis.	**DATA ANALYSIS—EXPERIMENT PLAN** Using the hypothesis you developed and the teacher's graphic ("solidify experiment plan"), answer the following prompts in your notebook: 1. What is your hypothesis? 2. Complete the following statement: "We will look for _____." 3. Identify your two (or more) variables. 4. Name the independent variable(s). 5. Name dependent variable. 6. Name your ideal data set (what are you searching for?).	A mastery-level student response will: • Provide appropriate answers to all of the prompts.	This mini-task is built upon the "Data Analysis—Develop a Hypothesis" mini-task. 1. Display the attached file under "teacher resources." 2. Allow students time to answer the prompts in their groups in their notebooks.
	Additional Attachments: **solidify experiment plan.pdf**			
Selecting a Data Set				
1 hr and 30 mins	**RESEARCHING HOW OTHERS HAVE ATTEMPTED TO ANSWER SIMILAR QUESTIONS**: Ability to analyze how other researchers have previously addressed a similar research question.	**DATA ANALYSIS—REFERENCE SEARCH** Find three new articles that work to answer your hypothesis. You may use references from your previous three articles. Read the three articles, focusing especially on the methods and results sections, and add entries for each article in your annotated bibliography.	A mastery-level student product should: • Include three new articles relevant to the student's hypothesis • Include citations and annotations for each article in the student's annotated bibliography.	1. Review with students how to search scientific articles. 2. Review with students how to use references section to find additional resources.
40 mins	**LOCATING DATA SOURCES THROUGH THE REFERENCES OF OTHER TEXTS**: Ability to use similar research reports as a spring board to finding potentially appropriate data	**DATA ANALYSIS—POTENTIAL DATA SOURCES** Using the six total articles you found, plus those your group members found, find potential data sources. Turn to the bibliography or works cited pages. As a group, find the	A mastery-level student response will: • Cross-reference the works cited/bibliography entries from all group members • Identify research and studies cited across group	Arrange students in groups. Allow time for discussion. Circulate and confirm students' work.

	sources.	writers/researchers/authors that appear across different articles. Find any studies cited in multiple articles. List five potential data sources your group may use.	members' articles • List five potential data sources.	
20 mins	**ANALYZING DATA: VARIABLES**: Ability to analyze data sources for inclusion of variables identified in one's hypothesis.	**DATA ANALYSIS—DATA ANALYSIS TABLE** Make a copy of the teacher-supplied Google Document, "Analyzing Data: Variables and Quality." Complete the table for your five potential data sets which you identified across your groups' articles. What is the sample size in the data set? (Example: How many students were studied?) What is the population of the same size? (Example: Were the students enrolled in a specific university? What are the demographics of the sample [race, gender, etc.]?) What are the variables studied within the sample? (Example: hours spent studying, socioeconomic status, familial support, etc.) What are the potential issues with the data? (Example: The sample size is very small. The sample was taken using unreliable collection methods. The sample is incomplete.)	A mastery-level student response will: • Include a completed table • Thoughtfully consider each component in the table • Include five potential sources of data.	1. Share the Google Document with the students **Analyzing Data: Variables and Quality** . 2. Circulate and help students complete the table in the file. 3. Confirm that an appropriate data source is available to students.
	Additional Attachments: **Selecting Data Set Google Document**			
20 mins	**ANALYZING DATA: QUALITY**: Ability to research methods used to gather data in order to identify potential problems / shortcomings of data:	**DATA ANALYSIS—DATA ANALYSIS TABLE (CON'T)** Complete the table that you began in the previous mini-task (Data Analysis—Analyzing Data	See scoring guide for "Data Analysis—Analyzing Data (Variables)."	See strategies for "Data Analysis—Analyzing Data (Variables)."

	bias, lack of completeness, unreliable collection methods, etc.	[Variables]).		
20 mins	**COMPILING A FINAL DATA SET**: Ability to select one or more appropriate final data sets to analyze based on the sample, completeness, variables, and potentials issues of the data sets.	**DATA ANALYSIS—FINAL DATA SET** Based on the table you completed, as a group, choose one or more final data sets to analyze. Consider: • The size of the data set • The completeness of the data set • If the variables in the study align with your own • If there are too many potential issues with the data	A mastery-level student response will: • Include a final data set.	Allow students time to collaborate to agree upon a data set. Circulate and ensure that students are selecting appropriate data sets.
Interpreting Data				
1 hr	**DEFINING DATA RELATIONSHIPS**: Ability to analyze and identify any clear (or unclear) relationship between the variables based on the data.	**DATA ANALYSIS—DATA PLOT** View YouTube instructional video. Review teacher-supplied resources. Export or enter the data set(s) you located in Excel or Google Sheets. Experiment with different relationships using the variables from your research question. Use plot functions in Excel/Google Sheets. Record the data relationships you find.	A mastery-level student response will: • Include data relationships created in Excel/Google Sheets.	1. View "YouTube 01" with students. 2. Make "LabWrite resource" and "OwlNet resource" available to students. 3. Circulate and aid students with data exploration.
	Additional Attachments: **YouTube 01** **YouTube 01** **OwlNet resource** **OwlNet resource** **LabWrite resource** **LabWrite resource**			
30 mins	**DRAWING CONCLUSIONS FROM DATA**: Ability to build a persuasive, data-based case that clearly states the relationship between variables in a data	**DATA ANALYSIS—RELATIONSHIP OF DATA** Review types of relationships of data using the "UCLA resource" and "Social Research Methods resource."	A mastery-level student response will: • Name the relationship between variables.	1. Distribute UCLA resource and Social Research Methods resource. 2. Help students describe the relationship between their variables.

	set.	Review your data and state the relationship between variables. **Note:** Relationships can be named as positive, negative, unclear, "no relationship," etc.		
	Additional Attachments: **Social Research Methods resource** **Social Research Methods resource** **UCLA resource** **UCLA resource**			
1 hr	**STATING FINDINGS IN CONTEXT OF EXISTING BODY OF KNOWLEDGE**: Ability to relate how data findings contribute to the overall body of knowledge about a research topic.	**DATA ANALYSIS—RESULTS COMPARISON** Refer to your annotated bibliography entries from the articles you and your group have reviewed for this unit. Compare your data to what you found in the articles. Reference your data in the larger body of knowledge created from the articles. Put your data in conversation with this body of knowledge. How do your data and that knowledge match up? Were there any surprises? Were there any problems with your analysis?	A mastery-level student response will: ● Reference the body of knowledge ● Place their data in conversation with the body of knowledge ● Address how their data and the body of knowledge match or conflict ● Address any problems with data analysis.	1. Model creating a table with two columns ("What other sources say" and "What my data says") and comparing data sources. (See attached PDF for a model.) 2. Allow students collaborative time to compare their data with their background research. 3. Circulate and aid students in finding data relationships and/or discrepancies.
	Additional Attachments: **Results_Comparison 2016.01.18.pdf**			
25 mins	**STATING FINDINGS IN CONTEXT OF EXISTING BODY OF KNOWLEDGE**: Ability to relate how data findings contribute to the overall body of knowledge about a research topic.	**REVIEWING COMPETING ARGUMENTS (HANDOUT)** Identify and write the competing argument to your claim, and write the reasons used to support that competing argument.	A student product which meets expectations should: ● Identify a competing claim ● Identify the evidence supporting this claim.	1. Do Now: Your mom tells you that you can't use your phone in the evenings because you should be doing your homework. Using formal language, try to convince her otherwise. Have students pair and share, and then tell them you just created a "competing argument." Try to guess what this means. 2. Provide students with a definition of "competing argument": something that goes directly against the argument you are trying to make. 3. Provide a content-specific example that is not the writing task. For example, "The Industrial Revolution was good for women because they got to work." Have the class work together to formulate a counterclaim. Model thinking and writing using the same format found in the worksheet, so students are familiar with it before they receive it.

				4. Give students the following directions: "Today, you are going to imagine that you are not you, but rather someone else, and come up with an argument they could make to prove you wrong. Include some evidence. Remember: There's more than one right answer to this prompt." 5. Circulate the room helping students. 6. Pair/share.
	Standards: **CCR.W.5** : Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach. **CCR.W.4** : Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **CCR.W.1** : Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.			
	Additional Attachments: **Reviewing Competing Argument-Student Work.pdf** **Reviewing_the_Competing_Argument.pdf** **Reviewing_the_Competing_Argument.doc**			
30 mins	**STATING FINDINGS IN CONTEXT OF EXISTING BODY OF KNOWLEDGE**: Ability to relate how data findings contribute to the overall body of knowledge about a research topic.	**ANALYSIS OF GAPS AND UNANSWERED QUESTIONS** Consider what you have learned through this analysis of data. What questions did you start the project with that are still not answered? What gaps do you see in the data?	A mastery-level product will: • List all questions that remain unanswered • Identify gaps in the data.	1. Students return to their data. 2. Students get time to discuss original questions. 3. Students get time to discuss gaps in the data.
40 mins	**IDENTIFYING DATA ANALYSIS LIMITATIONS**: Ability to identify and articulate known weaknesses in the data analysis (e.g., small sample size, highly variable data, assumptions in interpretation, etc.)	**DATA ANALYSIS—DISCUSSION PARAGRAPH** Write a reflection paragraph that includes: • A statement as to whether your hypothesis was supported or not AND • A description of possible sources of error AND • A description of the limitations of the investigation AND • Suggested solutions to these sources or error AND • "Next steps" determined as a result of this investigation. Note to students: Sources of error may include:	Reflection paragraph includes: • A statement as to whether the hypothesis was supported or not AND • A description of possible sources of error AND • A description of the limitations of the investigation AND • Suggested solutions to these sources or error AND • "Next steps" determined as a result of this investigation. Note: Sources of error may include: investigation design,	This lesson is used for support in writing the discussion paragraph of a scientific investigation. The worksheet will help students write a thoughtful reflection on their work. Instructional Strategies will vary, but a possibility is that students can help each other generate the constants in order for students to understand their own errors and limitations.

		investigation design, environmental factors, unexpected or unaccounted variables, etc.	environmental factors, unexpected or unaccounted variables, etc.	
	Additional Attachments: **Discussion Support Worksheet**			
Writing and Presenting a Data Analysis Report				
50 mins	**WRITING THE BACKGROUND SECTION**: Ability to clarify a question being studied, explain how other researchers have attempted to answer that question, and provide the rationale for the selection of the data set(s) being used in the current analysis.	**DATA ANALYSIS—PURPOSE, BACKGROUND, AND SOURCES** Write an introduction to your data analysis report in which you explain the purpose of your data analysis and provide background information. Background should summarize your research on the topic.	A mastery-level Background section includes: ● Relevant and clearly stated purpose ● Thorough explanation of background information ● Properly cited, relevant sources.	Not Provided
	Standards: **WHST.6-8.1.A** : Introduce claim(s) about a topic or issue, acknowledge and distinguish the claim(s) from alternate or opposing claims, and organize the reasons and evidence logically. **WHST.6-8.2.A** : Introduce a topic clearly, previewing what is to follow; organize ideas, concepts, and information into broader categories as appropriate to achieving purpose; include formatting (e.g., headings), graphics (e.g., charts, tables), and multimedia when useful to aiding comprehension.			
25 mins	**WRITING THE DATA SECTION**: Ability to represent data in both figures and text.	**DATA ANALYSIS—CLAIM, EVIDENCE, WARRANT** Make a claim based on your research and analysis to provide evidence with reasoning to answer the teaching task.	Student work meets expectations if: ● The claim is based on information gathered from data or research ● The evidence supports the claim ● Reasoning is credible and believable.	1. Show the following video to the class on Claim, Evidence, and Reasoning. ● https://www.teachingchannel.org/videos/support-claims-with-evidence-getty 2. Have the students pair off and discuss the following questions: ● How might we make a claim using data? ● How might we use data as our evidence? ● What type of reasoning will support our evidence? 3. Instruct students to make a claim based on the data analyzed. ● Analyze the data to find a pattern to base your claim on. ● The claim answers the teaching task. ● Base your claim on your research (both reading and data analysis). 4. Instruct the students to answer the question, "What evidence supports your claim from your observation or data analysis?" ● Support your claim with evidence from the

				reading. ● Support your claim with evidence from the data you analyzed. 5. Instruct the students to answer the question, "What is your reasoning based on prior knowledge that creates a logical inference?" ● What makes sense? ● What logical inference have you made from the data? ● What is your reasoning based on prior knowledge? 6. The technical teams will group together to discuss their claims based on the data the research team collected. ● While each student presents their claim, the other team members write questions to disprove the claim. ● They will discuss the questions after each student presents their claim. ● Once they have finished debating, they will come to a consensus. ● The team's technical report will use the claim with the strongest evidence and reasoning.
	Standards: **RI.9-10.8** : Delineate and evaluate the argument and specific claims in a text, assessing whether the reasoning is valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning. **RST.9-10.7** : Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.			
	Additional Attachments: **Teacher Channel Claim, Evidence, Reasoning Video** **Claim Evidence Reasoning.docx** **NSTA Rubric to provide feedback** **A series of CER's used in classrooms**			
50 mins	**WRITING THE DATA SECTION**: Ability to represent data in both figures and text.	**DATA ANALYSIS—CLAIM, EVIDENCE, AND WARRANT (RESPONSES TO A DATA TABLE)** In complete sentences, write a scientific claim that is backed up by evidence and supported by scientific reasoning. Base your answer on your reading of a data table.	Student work meets expectations if it: ● Makes a defendable and complete claim ● Provides appropriate and sufficient evidence from the data to support the claim ● Provides reasoning that succinctly links evidence to the claim ● Includes appropriate and sufficient scientific principles.	(See attached Instructional Plan for details on how to use this CER mini-task in any course where students will form arguments from reading data.) 1. Review definitions of "claim," "evidence," and "reasoning," and discuss how they are connected. 2. Model how to construct a claim from a simple (and unrelated to target content) data set to help students learn this new skill. Then model how to write statements that support the claim using evidence and reasoning. 3. Have students practice writing claims and evidence/reasoning statements using the same non-content-based data set. Have them pair-share their own claim/evidence/reasoning statements and/or share out with the whole class. 4. Introduce the actual data set and prompt for the

				actual target content (in this example, it is a chemistry data set about bonding). 5. Have students work individually or in pairs to complete the full process with the target content. Share out or score all work, and repeat process if necessary. **Additional Instruction:** This particular mini-task was written for a high-school-level chemistry course (content: bonding), but could be adapted to be used in non-science courses where students need practice writing scientific claims based on information they read from a data table. The attachments include versions of the actual worksheets used for the chemistry/bonding activity that can be adapted for other uses, but also a full instructional plan that proposes how to use this mini-task with any content related to reading data tables and then writing CER statements based off of it, as well as a template to adapt for other content.
	Standards: **CCR.R.8** : Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence. **CCR.R.1** : Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.			
	Additional Attachments: **CER Example 1.docx** **CER_StudentWork.pdf** **CER_RUBRIC.pdf** **CER Template.docx** **CER Data Table Instructional Strategies.docx**			
1 hr	**WRITING THE DATA SECTION**: Ability to represent data in both figures and text.	**BEST FIT FOR DATA REPRESENTATION** Create a graph that effectively represents the data set provided.	Student work that demonstrates mastery of this skill will: • Include an appropriate graph format to represent data set • Include all necessary components of chosen graph • Be formatted in a way that presents information clearly.	**Warm-Up:** Hand out a variety of graphs to each table. Pose the question, "What information is being shared in each of the tables/graphs?" In small groups, have students compare and contrast the different tables/graphs and the information they present. After 5 minutes open the discussion up to the entire class. **Direct Instruction:** As a class, make a list of the different types of information that can be represented by each table or graph. Have students record this information in their notes. **Modeling:** Choose a set of data, or conduct a quick poll of the

				class to create a sample set of data (examples: How many siblings do you have? Daily high temperatures over the last week for your particular location.), and model how to set up and graph results. Make sure to demonstrate how to set up the table as well as the decision-making process for choosing a graph type. **Practice:** Provide students with various data sets and have them work in pairs to graph data. Have students share out their graphs and the process they went through while working. Teacher will circulate and listen to students articulate why they selected each graph as the best choice to represent data. **Extension:** Optional homework: Every student takes multiple sets of data home and practices graphing each.
	Standards: **CCR.W.9** : Draw evidence from literary or informational texts to support analysis, reflection, and research. **CCR.W.4** : Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **CCR.W.2** : Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. **CCR.R.7** : Integrate and evaluate content presented in diverse media and formats, including visually and quantitatively, as well as in words. **CCR.R.6** : Assess how point of view or purpose shapes the content and style of a text. **CCR.R.1** : Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. **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. **8.SP.4** : Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible association between the two variables. Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. Graphs, charts, and images can be used to identify patterns in data.			
	Additional Attachments: **Site that Generates Real-World Data Sets** **Printable Graph Paper.pdf** **Example Graphs Website**			
45 mins	**WRITING THE DATA SECTION**: Ability to represent data in both figures and text.	**CREATING RESULT IN GRAPH, TABLE, AND/OR WRITTEN FORM** Construct a graph of the results of your experiment and write a caption that expresses the data relationship contained in	Mastery-level student work will include: • A line or bar graph constructed correctly expressing the data collected • Labels and/or values	**Note:** Students can revisit the graph analysis from "Creating Google Spreadsheet to Create Graphs" to review the types of graphs. 1. 15 minutes: Pair students up and have one student bring up the Introduction to Describing Graphs and Table activity link (see student handout). Have the students work together to

		your hypothesis.	of collected data ● A caption that expressed the data relationship contained in the hypothesis.	complete the four activities. 2. Walk around the classroom and troubleshoot any issues students are having. 3. 1 minute: Have student bring up graph previously made on Google Spreadsheet or graph paper for their experiment. 4. 5 minutes: Have students review their previously made graph with their experimental group for consistency in the produced graph and for graph labels. Some students may need to make adjustments. 5. 5-7 minutes: Have students gather the following information about their experiment: ● Start by saying exactly what the chart/graph shows and the time period, if applicable. ● Describe the changes as precisely as possible. Use data and numbers from bar or line graph. ● Compare the information. Talk about the difference and similarities between the data shown. ● Conclude by saying what the major trends are. 6. 5 minutes: Look at examples of graph captions and model how to create a clear caption. 7. 7-10 minutes: Students work with group to create a clear and well-written caption to accompany their chart/graph. 8. 2 minutes: Type the final caption that expressed the data relationship contained in the hypothesis.
	Standards: **CCR.W.4** : Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **CCR.W.2** : Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content. **MS-LS4.SEP.1.1.** : Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3) **MS-LS2.SEP.3.1.** : Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2) **MS-PS3.SEP.3.1.** : Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)			
	Additional Attachments: **Using Graphs and Charts to Illustrate Quantitative Data** **Writing about a Bar Chart** **Writing about a bar chart** **Introduction to describing graphs and tables**			
50 mins	**WRITING THE CONCLUSIONS SECTION**: Ability to communicate conclusions that were drawn based on the data, how those	**DATA ANALYSIS—CONCLUSION** Write a conclusion section that: ● Addresses the factors you analyzed	Student work that meets expectations should: ● Provide all elements of a conclusion ● Provide sufficient	Depending on the experience and needs of your students, model and talk through the elements of this mini-task. Help students understand that a conclusion follows from all that precedes it.

	conclusions are similar or different to the conclusions others have drawn, and how those conclusions may be limited.	• States whether or not the data supported the hypothesis • Discusses significant results and explains the relationship between the data and the body of knowledge on the topic • Identifies any limitations out of your control • Generates new questions.	discussion and explanations • Be written clearly and concisely.	
	Standards: **WHST.6-8.1.E** : Provide a concluding statement or section that follows from or supports the argument presented.			
1 hr	**WRITING AN EXECUTIVE SUMMARY**: Ability to summarize findings in a succinct, clear, and accurate manner.	**DATA ANALYSIS—EXECUTIVE SUMMARY** Create an executive summary of your findings.	A mastery-level student response will: • Include a complete and thorough executive summary of findings.	Introduce students to the Navy and Marine Corps Public Health Center resource on writing executive summaries. Allow students time to collaborate and write their executive summaries.
	Additional Attachments: **Navy and Marine Corps Public Health Center** **Navy and Marine Corps Public Heath Center**			

Instructional Resources

Student Handout

- **Social Research Methods**
- **The Data and Story Library**
- **Data.gov**
- **Center for Medicare and Medicaid Services (CMS) Data navigator**
- **JSTOR**
- **The Ohio State University library**

Teacher Resource

- **Social Research Methods**
- **VIDEO: LDC Data Analysis: Identifying Variables**

Section 4: What Results?

Student Work Samples

Advanced

- Sample 6 Serial Killers paper only.pdf
- Sample 6 Serial Killers scored rubric only.pdf
- Dogs and Mental Health paper.pdf
- Concussions.pdf

Meets Expectations

- Sample 7 TV and obesity paper only.pdf
- Sample 7 TV and obesity scored rubric only.pdf
- Sample 7 TV and Obesity.pdf
- Organic foods paper.pdf
- Organic foods ppt.pdf

Approaches Expectations

- Sample 8 Urban Gardening paper only.pdf
- Sample 8 Urban Gardening scored rubric only.pdf

Teacher Reflection

Students performed as well or better than I expected on this project, as a group. They engaged deeply with their chosen content and really dug into some data analysis.

Students seemed to do well on the "Controlling Idea" and "Analyze & Interpret Data" sections of the rubric. They also did pretty well on "Conventions" and "Organization." Many of them struggled with the "Disciplinary Core Ideas" and "Ask Questions" parts of the rubric.

When I teach this module again, I will first revise it and add a mini-task on relevant vocabulary and layout of scientific vocabulary. I was surprised that students did not have as much experience writing scientific reports as I had anticipated. Students asked for sample student work, which I will now be able to provide. I will also add a mini-task where students explain their methods of data collection and analysis. It may also be fruitful to have students design their own study after formulating a hypothesis, then allow them to revise their proposed study after performing two rounds of background research. I want to add a task where students engage with statistics and practice their statistical analysis before asking them to analyze the data they found.

All Attachments

- Text resources.docx : https://s.ldc.org/u/39terle9z1ztdc1gln9zqp40l
- Sample 6 Serial Killers paper only.pdf : https://s.ldc.org/u/eahg8t9e2l5r80xvr8vib6dkz
- Sample 6 Serial Killers scored rubric only.pdf : https://s.ldc.org/u/8jydf2xgu3scmshgs2hdyjfdw
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- The Data and Story Library : https://s.ldc.org/u/akz84iokuir3cc88261gun1ow
- Data.gov : https://s.ldc.org/u/7k8oqwvslmjh9inoqeoy9u132
- Center for Medicare and Medicaid Services (CMS) Data navigator : https://s.ldc.org/u/2h09k0vsrocre239ls58vrlkn
- JSTOR : https://s.ldc.org/u/bckffpsojihfxsts4qjycrv8t
- The Ohio State University library : https://s.ldc.org/u/bthvh4tq56sfz0caha6xzkw7n
- VIDEO: LDC Data Analysis: Identifying Variables : https://s.ldc.org/u/d8l4eloe378fgtencj233b9cp