

Intel® Teach Elements

Thinking Critically with Data

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Instructions: Click any of the activity names in the Contents to go directly to that section.

Contents

Module 1: Information in Society and the Classroom	3
Lesson 1: Critical Thinking in the Digital Age	3
Activity 3: Critical Thinking	3
Lesson 2: Critical Thinking about Data.....	3
Activity 4: Visual Representation.....	3
Lesson 3: Data Projects	4
Activity 2: Student-Centered Projects	4
Lesson 4: Module Review	4
Activity 1: Module Summary	4
Module 2: Project Design for Critical Thinking.....	5
Lesson 1: Types of Projects	5
Activity 3: Collaborative Projects.....	5
Lesson 2: Learning Goals	5
Activity 2: Learning Objectives	5
Lesson 3: Critical Thinking Assessment.....	6
Activity 1: Assessment of Data Processes.....	6
Lesson 4: Data Sources.....	7
Activity 2: Online Data Sources	7
Lesson 5: Module Review	7
Activity 1: Module Summary	7
Module 3: Skills for Thinking Critically with Data	8
Lesson 1: Data Collection	8
Activity 3: Strategies for Accuracy	8
Lesson 2: Data Analysis	8
Activity 2: Patterns and Relationships.....	8
Lesson 3: Conclusions.....	9
Activity 2: Common Errors in Data Interpretation.....	9
Lesson 4: Research Outcomes.....	9
Activity 2: Research Cycle.....	9
Lesson 5: Module Review	10
Activity 2: Module Summary	10

Module 4: Tools for Effective Data Analysis	11
Lesson 1: Data Organization with Technology	11
Activity 2: Data Organization	11
Lesson 2: Visual Presentation of Data	12
Activity 3: Conceptual Data Displays	12
Lesson 3: Results with Technology	12
Activity 2: Tools for Data Presentation	12
Lesson 4: Showing Evidence	13
Activity 2: Showing Evidence Examples (Optional)	13
Lesson 5: Module Review	13
Activity 2: Module Summary	13
Module 5: Critical Thinking and Instruction	14
Lesson 1: Data Skills Instruction	14
Activity 5: Mini-Lessons and Critical Thinking	14
Lesson 2: Management of Projects with Data	14
Activity 2: Self-Direction	14
Lesson 3: Data Collection in the Field	15
Activity 1: Fieldwork	15
Lesson 4: Module Review	15
Activity 1: Module Summary	15
Course Wrap-Up	16
Summary	16

Module 1: Information in Society and the Classroom

Lesson 1: Critical Thinking in the Digital Age

Activity 3: Critical Thinking

Estimated Time: 15 minutes

How do students access and use information and data in your class? Look over the Critical Thinking Skills document and record any of the skills or subskills your students use in your class in the space below.

Students gather facts, classify data, find relationships using inductive and deductive reasoning, and draw conclusions. They evaluate hypotheses based on data. They use methodical thinking when following the scientific method and scientific inquiry. Students use journals to reflect on their learning, using metacognitive skills.

Module 1: Information in Society and the Classroom

Lesson 2: Critical Thinking about Data

Activity 4: Visual Representation

Estimated Time: 15 minutes

What activities in your classroom involve students using data? What kind of data do they use? How do they use the data? List the activities below.

My students “create” their own data through experiments and labs, and measure and record their observations. They access data from the Internet to help them with projects—such as ones involving personal health, structure of the Earth, the solar system, ecosystems—needing background information or data to support their hypotheses. I try to have my students use authentic data and real-world questions to investigate phenomena, whether in the classroom, outdoors, or in a laboratory setting.

Module 1: Information in Society and the Classroom

Lesson 3: Data Projects

Activity 2: Student-Centered Projects

Estimated Time: 15 minutes

Think about lessons or activities that you already do, or plan to do, that could be improved by incorporating the Data Project Process. Record your ideas below.

My space exploration project could certainly benefit from the Data Project Process. My nutrition unit could benefit from real-world data and support from this process as well. I haven't done a project when studying energy—we've mostly done labs and experiments—but I think the Data Project Process could help me identify a good project using real-world data, maybe something on renewable energy.

Module 1: Information in Society and the Classroom

Lesson 4: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module.

I like the simplicity of the Data Project Process—it's thorough, yet easy to understand. I could see how it would apply well to short projects and long, involved projects that require the use and analysis of data. The project ideas were really useful to help me think of new ways of approaching the topics I teach. I also appreciated the review of critical thinking skills—I'll keep that document handy when looking at how to improve my next unit.

Module 2: Project Design for Critical Thinking

Lesson 1: Types of Projects

Activity 3: Collaborative Projects

Estimated Time: 10 minutes

Choose a unit to create or enhance through an emphasis on thinking critically with data.

Unit Description	Nutrition unit—collecting data on student eating habits and calorie intake, and the types of food offered at the cafeteria
Type of Project	Descriptive and Persuasive—to present information about student eating habits and a plan for improving school lunches

Module 2: Project Design for Critical Thinking

Lesson 2: Learning Goals

Activity 2: Learning Objectives

Estimated Time: 10 minutes

Identify the standards you will address in your unit.

Oregon Science Standards

7.3S.1 Based on observations and science principles, propose questions or hypotheses that can be examined through scientific investigation. Design and conduct a scientific investigation that uses appropriate tools and techniques to collect relevant data.

7.3S.2 Organize, display, and analyze relevant data, construct an evidence-based explanation of the results of an investigation, and communicate the conclusions including possible sources of error.

Oregon Health Standards

Compare and contrast the food groups, nutrients and serving size in the USDA recommended guidelines.

Explain the importance of variety and moderation in food selection and consumption.

National Health Education Standards

Standard 8: Students will demonstrate the ability to advocate for personal, family, and community health.

Write objectives related to content learning and data skills for your unit.

Students will:

- Classify and analyze the nutritional values of foods
- Identify and define the nutritional needs of students in their school
- Collect, organize, classify, identify patterns, evaluate, and analyze data related to student eating habits and the food available at the cafeteria
- Draw conclusions based on data on what influences student food choices, and reflect on their own and their fellow students' eating patterns
- Develop a persuasive plan to improve healthy eating choices at school

Module 2: Project Design for Critical Thinking

Lesson 3: Critical Thinking Assessment

Activity 1: Assessment of Data Processes

Estimated Time: 20 minutes

Describe how you will adapt and use different assessments of critical thinking.

Assessment	How You Will Adapt and Use It
Student Observation Checklist	Add critical thinking components that mention specific skills I will monitor while students collect, organize, and analyze data; use some of the content from the Reasoning Observational Checklist from <i>Assessing Projects</i> .
Project Rubric	Add specific critical thinking skills (remember to review Critical Thinking Skills document); add elements from the Argumentation Rubric from <i>Assessing Projects</i> .
Journal	Make sure journal prompts require students to think critically about the data they're collecting, the questions they have, the tentative answers they have come up with, and so on.
Self-Assessment Checklist	Add components that will help students think about the critical thinking strategies they are using as they collect, analyze, and make conclusions about their data

Module 2: Project Design for Critical Thinking

Lesson 4: Data Sources

Activity 2: Online Data Sources

Estimated Time: 20 minutes

Describe the data sources that will be most relevant for your students in your project.

Data Source	Where to Find	Student Support
Nutrition surveys	Need to create guidelines; use online and cell phone tools	Show students how to use technology tools to record interviews and collect survey responses
Calorie calculator	Online, applications for cell phones	Demonstrate and practice counting calories of a typical student lunch; discuss serving size and measurements
Dietary requirements for different age groups	FDA	Help understanding vocabulary, food pyramid

Module 2: Project Design for Critical Thinking

Lesson 5: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module. How might you use what you have learned in your teaching beyond the unit you have selected to target?

It was useful to review and revise the standards and objectives for my nutrition unit and ensure critical thinking skills were addressed. I plan on revisiting especially the objectives of all my future units. The sample assessments and ways of conducting ongoing assessment helped me to expand assessment in this and other units. I was surprised how many tools are available today to support and record healthy eating. I'll have to remember to look for and incorporate similar tools in other units.

Module 3: Skills for Thinking Critically with Data

Lesson 1: Data Collection

Activity 3: Strategies for Accuracy

Estimated Time: 15 minutes

What specific research question(s) could your students develop? What strategies will you employ to help your students think more critically about the data they collect so that it is more accurate and free of bias?

How healthy are our school's students?

How can we plan and follow a healthy, nutritious, and *appetizing* diet?

Students need to be taught how to measure units of food accurately and consistently. The other concern is to help students accurately record *all* food being consumed—technological tools could help with that.

Module 3: Skills for Thinking Critically with Data

Lesson 2: Data Analysis

Activity 2: Patterns and Relationships

Estimated Time: 10 minutes

Recall Marzano's (2000) identification of the five ways of analyzing:

- Matching
- Classifying
- Error analysis
- Generalizing
- Specifying

What analysis skills do your students need to develop? How will you incorporate the organize-check-analyze process for data analysis? Add appropriate critical thinking skill and data analysis objectives to the ones you drafted in [Module 2, Lesson 2, Activity 2](#).

Module 3: Skills for Thinking Critically with Data

Lesson 3: Conclusions

Activity 2: Common Errors in Data Interpretation

Estimated Time: 20 minutes

Draft your plans for how your students will organize, check, analyze, and draw conclusions using data.

Data Interpretation Step	Plans for Student Process
Organize	Enter observational and survey data into a spreadsheet
Check	Have students work in teams and double-check handwritten work with spreadsheet answers. Compare multiple surveys of student eating habits to ensure consistency.
Analyze	Identify and sort food into food groups and appropriate serving sizes. Sort and compare data in different ways. Look for anomalies and completeness of data.
Draw Conclusions	Step back from all data and notice patterns. Summarize and generalize data appropriately to get an accurate picture of our student body as a whole. Display the data in a graphical form so it's easier to understand and relate the data to the goal of the project.

Module 3: Skills for Thinking Critically with Data

Lesson 4: Research Outcomes

Activity 2: Research Cycle

Estimated Time: 15 minutes

How might you build on the learning from your project to help your students continue asking questions and develop a deeper understanding of the subject matter?

Maybe for next year:

Students could compare the eating habits of the students from their school with the students of another school—and make it a collaborative project.

But more likely for this year:

Students could use their research on nutritional requirements and student preferences to build menus offering healthier choices that students would eat. They could work with the district nutritionist to make changes in the cafeteria offerings.

Module 3: Skills for Thinking Critically with Data

Lesson 5: Module Review

Activity 2: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module.

I need to teach my students to be more effective in evaluating their data, and especially focus on data collection problems that can occur. My students might need help with entering data into spreadsheets and how to organize that data, so I'll need to spend some time discussing various methods and how to set up a spreadsheet. I liked the content about the different ways data can be analyzed depending on what kind it is. I hadn't really thought about all of those possibilities.

Module 4: Tools for Effective Data Analysis

Lesson 1: Data Organization with Technology

Activity 2: Data Organization

Estimated Time: 15 minutes

How will your students collect and sort data? What skills will they need to develop?

How will this process fit into the overall project? Record your thoughts below.

How will students collect and sort data?	<ul style="list-style-type: none">• Use smartphones and online nutrition or diet sites to collect data on all food eaten over a given period of time.• Use online or smartphone apps to convert food to calories.• Use online surveys to capture student feedback on their opinions about healthy eating and food served at the cafeteria.• Categorize food into food groups.• Move data from these resources to a spreadsheet. Sort individual data into different categories, such as male/female, athlete, grade level, and so on.
What skills will they need? How will they be taught?	<ul style="list-style-type: none">• I need to research the most appropriate technology tools for them to use and give them mini-lessons on how to use them.• We need to have a lesson on serving size and measuring.• We need to have several mini-lessons on how to set up and enter data appropriately on a spreadsheet and cross-checking data.• I will provide them the Survey Prep and Design Tips document to help them when designing their surveys.• I'll also show them how to use the <i>Help Guide</i> to get step-by-step instructions on using spreadsheets.
How will these activities be integrated into the project?	Usually these can be short activities added to the beginning of the period when students will be using the tools. I can also create some printed instructions for their reference later.

Module 4: Tools for Effective Data Analysis

Lesson 2: Visual Presentation of Data

Activity 3: Conceptual Data Displays

Estimated Time: 10 minutes

How might students display their data during your project to share their conclusions?
What skills will you need to teach your students so they can display their data effectively?

How will students display their data?	Bar charts and pie charts will likely be used by students to help analyze food types and student categories. Some might choose to use a scatterplot to analyze calories or nutritional information of the food served at the cafeteria.
What skills will they need? How will they be taught?	We will build on the spreadsheet lessons on how to select different ways of displaying data and how to choose the best method depending on the message and data. Again, we'll use the <i>Help Guide</i> to get step-by-step instructions on using spreadsheets.

Module 4: Tools for Effective Data Analysis

Lesson 3: Results with Technology

Activity 2: Tools for Data Presentation

Estimated Time: 10 minutes

What online tool(s) would you like to investigate for your students to use?

Online Tool	URL	Possible Use
<i>Showing Evidence</i>	www.intel.com/education/showingevidence	At the end of their research, they can use <i>Showing Evidence</i> to help prepare for their presentations to school administrators.
Calorie Counter and Diet Tracker by MyFitnessPal	iPhone* app for those with iPhones	Track individual's food intake
MyFitnessPal Calorie Counter, Diet & Exercise Journal	www.myfitnesspal.com	Track individual's food intake

SurveyMonkey	www.surveymonkey.com	Online survey creation site to poll students on their eating habits and preferences
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Module 4: Tools for Effective Data Analysis

Lesson 4: Showing Evidence

Activity 2: Showing Evidence Examples (Optional)

Estimated Time: 15 minutes

If you decide to use the *Showing Evidence Tool*, what prompt could you use? What type of evidence will your students use?

Showing Evidence Prompt	How can we improve the eating habits of students?
Type of Evidence Required	<p>Data on what students currently eat for lunch and nutritional analysis/summary</p> <p>Data/nutritional analysis of the food served at the cafeteria</p> <p>FDA nutritional guidelines</p>

Module 4: Tools for Effective Data Analysis

Lesson 5: Module Review

Activity 2: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module.

It was really interesting to see all the online and cell phone related applications that students can use for free for collecting data for their project. I think these tools will help keep them more engaged and help them collect more accurate data than if they were to simply use a pen-and-paper journal. The survey creation tips were really useful. I'll definitely use some of them when creating guidelines for my students. Since I have used *Showing Evidence* before in another project, I'm excited to see how it can support student arguments in this project. I think it's a great fit to bring all the data together for their presentations.

Module 5: Critical Thinking and Instruction

Lesson 1: Data Skills Instruction

Activity 5: Mini-Lessons and Critical Thinking

Estimated Time: 10 minutes

Identify some skills that you might teach with mini-lessons at different stages of your unit. As appropriate, include instruction in metacognition, data analysis, and drawing conclusions.

Stage of Unit	Skills to Teach
Beginning/unit introduction	Measuring food serving sizes accurately
Beginning/project planning	How to create accurate, unbiased surveys
Beginning/project planning	Introduction to statistics
Middle/collecting data	Setting up and entering data into a spreadsheet
Middle/collecting data	How to use online or cell phone tools
Middle/organizing data	Creating graphical representations of data
Middle/analysis	Steps for drawing conclusions
Throughout	Metacognitive skills through journal prompts
Throughout	Teacher questions to help students think about how they analyze data

Module 5: Critical Thinking and Instruction

Lesson 2: Management of Projects with Data

Activity 2: Self-Direction

Estimated Time: 15 minutes

If your unit is a group project, describe how you will manage collaboration. If you are not planning a group project, how will you manage collaboration in general in your classroom?

I will create heterogeneous groups of 3 or 4 students per group. I will have ongoing individual assessments to help support accountability. Grading will include both group and individual effort. I will create a project plan template to help guide the work students need to accomplish along with who is responsible for which parts.

Module 5: Critical Thinking and Instruction

Lesson 3: Data Collection in the Field

Activity 1: Fieldwork

Estimated Time: 20 minutes

What kinds of fieldwork, if any, will your students be doing in your unit?

Students will observe students in the cafeteria and record their findings, conduct surveys at lunch, collect data about school lunches, and interview students and cafeteria staff for their opinions on eating healthier.

How will you prepare your students for successful fieldwork in a unit you teach?

Guide them on creating effective surveys, interviews, and data collection. Have each student in the group collect data and teach them how to look for anomalies. Encourage the use of recording devices on their phones or mp3 players for interviews while also taking notes and recording their personal impressions. For observations, take notes only on what they see and hear, and refrain from making any judgments.

What potential problems do you see in your project and how will you address them?

Potential Problems	How You Will Address
Students not recording accurately they eat—either underestimating or overestimating	Online/cell phone tools will help students record more accurately.
Student observations and interviews will miss important data	Observations and interviews by all students in a group will help to correlate and corroborate data.

Module 5: Critical Thinking and Instruction

Lesson 4: Module Review

Activity 1: Module Summary

Estimated Time: 5 minutes

Reflect on your learning in this module. How will you successfully manage your students' projects with data inside and outside the classroom?

It was useful to think through strategies that would help students be successful in their groups and self-directed learning. I'm glad I have built in redundant data gathering. I think that will be useful to help accuracy—as well as eye-opening for my students on how data can vary!

Course Wrap-Up

Summary

Estimated Time: 15 minutes

How will you use the ideas presented in the course?

I already have a good start on preplanning the revision of my nutrition unit through the use of this Action Plan. I feel much more confident on meeting the revised objectives for this unit that include targeting critical thinking skills. The checklists and assessment resources will be very useful to adapt for my students' use. I'm also really pleased with the integration of technology in this unit to support critical thinking, which I really hadn't incorporated before.