**Course 1: Food Production, Nutrition and Health**

**Project: How the Cookie Crumbles**

**Essential Question:** Can we bake a healthier sugar cookie that tastes like the original recipe?

**Engagement Scenario**: With obesity rates in the United States among the highest in the world, increasing from 13% in 1962 to 35.7% in 2010[[1]](#footnote-1), the head of baking at the \_\_\_\_\_\_ Foods Company has decided to offer a new version of the company’s best-selling sugar cookie using a healthier recipe. To accomplish this, the company has decided to hold a competition among teams of its bakers to determine which new recipe will be accepted and marketed.

Your team is to develop a new recipe while trying to maintain the desirable qualities of the current popular cookie. You are also responsible for designing a new package for the cookies – one that will help maintain the current sales level of the cookie. Develop a package on which all claims meet FDA standards. You will also design a food label that meets FDA standards.

A very important component of the competition is a sensory evaluation to determine if your new cookie tastes good enough to market. Your team will design and conduct a sensory evaluation as well.

To accomplish your task, you and your team will research the roles different ingredients play in cookie recipes and what can be done to make a cookie healthier. In addition, you will research the regulations regarding food labels and attributes of quality, marketing-friendly packaging. In order to judge the palatability of the new cookie, you will need to research how to design a sensory evaluation and quantify and analyze the results. You will keep your research notes, plans, and sensory test results in a research notebook.

After researching on-line resources and other informational texts on healthier recipes and sensory evaluation, and after participating in enabling activities in class, write a report to the officials of your company that compares the new cookies to the original cookies and argues for the inclusion of the new, healthier cookie in the company’s product line. Be sure to support your position with evidence from the texts and results from the sensory evaluation. You will research via the internet and will organize and treat data using an MS Excel spreadsheet with appropriate mathematical procedures. You will investigate how to experimentally determine caloric content of foods and calculate experimental error.

A presentation, based upon your report, will be presented to bakers and marketing officials in a format of your design. You will need to include data from the sensory evaluation and other supporting evidence from your research.

Your development team has to compete with other teams to create a healthy cookie for \_\_\_\_\_\_\_\_ Foods. The team with the best cookie will see their recipe through development and onto supermarket shelves. The food company executives want to see recipes, sensory evaluation results, packaging that meets FDA standards for nutritional claims on labels, and a clean label of ingredients that can be released to the public. You will deliver all of this in a 5-minute group presentation in a few weeks.

**Project Overview**

|  |  |
| --- | --- |
| **Day** | **Concept/Description** |
| 1 | Students describe the chemistry of baking cookies. Students describe the difference between baking and cooking. Students list the criteria for a cookie. |
| 2 | Students determine the scope/meaning of the project. |
| 3 | Students describe the ingredients of sugar cookies. Students describe the baking process for sugar cookies. |
| 4 | Students use ratios and proportions to adjust recipes for varying numbers of servings. |
| 567 | Students list the ingredients in a sugar cookie by food group. Students characterize each food group (chemical make-up, caloric content, form at room temperature, etc.). Students explain the role of each ingredient in the baking process and how the ingredients change during baking. |
| 89 | Students describe how caloric content of foods is determined. Students compare the caloric content of fat to sugars. Students determine sources of error in an experimental procedure. |
| 10 | Students determine alternative ingredients for their sugar cookies. Students develop a “new” healthier recipe. |
| 1112 | Students define sensory evaluation. Students develop a sensory evaluation protocol. |
| 13 | Students perform a paired t-test (or appropriate application). Students interpret statistical results and draw conclusions.  |
| 14 | Students use sensory evaluation protocol in a pilot test. Students perform paired t-test (or appropriate application). Students interpret statistical results and draw conclusions. |
| 15 | Students bake cookies following a recipe. Students demonstrate food and lab safety protocol. |
| 16 | Students use a sensory evaluation protocol. Students perform a paired t-test. Students interpret statistical results and draw conclusions. |
| 171819 | Students analyze data and draw conclusions. |
| 20 | Students discuss the results of a paired t-test and their implications. Students make decisions based on the analysis of quantitative data. |

**Day One**

**Key Question of the Day**: What is the science behind baking cookies? (Each day the key question should be prominently displayed and used to open the lesson.)

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What is your favorite kind of cookie? Why?”

**Learning Objectives**

As a result of this lesson, students will be able to:

* Describe the chemistry of baking cookies.
* Describe the difference between baking and cooking.
* List criteria for a cookie.

**Required Materials for Daily Lesson**

* Weekly Bell-Work journal – Appendix 1 - One per student
* Daily Exit Ticket – Appendix 2 – One per student
* Computer
* Projector
* Video – Cookie Chemistry
* Cookies (any type – remember to consider food allergies, one per student)
* Ingredients to make cookies (e.g., flour, sugar, salt, butter, vanilla, etc.)
* **Teacher TIP!** For the ingredients, feel free to bring in copies of the food labels if it’s too expensive or challenging to bring in the actual products.
* Flip chart paper
* Markers
* Index cards

**Estimated Instructional Time:** One 50-minute class period

**Opening –** (*Designed to prepare students for learning. Students are prepared for learning by activating an overview of the upcoming learning experience, their prior knowledge, and the necessary vocabulary*.)

* Read the Bell-Work question and solicit responses from the students.
* Possible responses could range from flavors of cookies, like chocolate chip or oatmeal raisin, to types of cookie textures, such as hard and crunchy or soft and chewy.
* Make a list of the responses on a sheet of flip chart paper.
* Explain that, “We can all agree that cookies are delicious. The amazing cookies you just described aren’t easy to make. There’s a science to baking the perfect cookie, and we’re going to learn more about that today.”

**Middle -** *(Designed to provide a structure for learning that actively promotes the comprehension and retention of knowledge through the use of engaging strategies that acknowledge the brain's limitations of capacity and processing.)*

* Ask the class, “What’s the meaning of the term bake?”
* Give students about 30 seconds to try and find the answer.
* Ask volunteers to share their responses.
	+ According to Merriam-Webster, bake means “to make food (such as bread or cake) by preparing a dough, batter, etc., and cooking it in an oven using dry heat.”
* Ask the class, “How is baking different from cooking?”
* Divide the class into groups and assign each group a method of cooking – frying, roasting, grilling, boiling, steaming, etc.
* Each group will research their method of cooking and list the characteristics and requirements for that method on a sheet of flip chart paper. At the bottom of the page, students should write one sentence explaining why their method of cooking would not be ideal for making cookies.
* Students will hang their flip charts around the room.
* Take about one-two minutes to have a gallery walk so that students can walk around the room and read all of the posters.
* Bring the class back together and debrief the exercise by having a brief discussion about the difference between cooking and baking.
* Explain that, “Cooking involves all types of techniques – frying, roasting, grilling, boiling, steaming, etc. These techniques use open flames, water, oil, or steam. Baking is different because it uses dry heat to obtain the desired end result.”
* Transition by giving each student a cookie. Ask them not to eat it.
* Ask the class to examine the cookie and make a list of all of the ingredients they think are in the cookie.
	+ **Teacher TIP!** Have the cookie ingredients set up somewhere in the room, but keep them hidden so that the students can’t see them. After students share their responses to this question, reveal the ingredients.
* Ask volunteers to share the ingredients on their lists. Capture the responses on a sheet of flip chart paper.
* Reveal the packages and compare the ingredients to the class list to see if the list was accurate. Cross out ingredients that aren’t needed and add any ingredients that were left off of the list.
* Explain that the main criteria for making cookies are right there in the list of ingredients. Each ingredient has a purpose. The only other items missing would be the oven and the baking sheet.
	+ Students can eat their cookies.
* Transition by showing the video “Cookie Chemistry” (in the “Video” folder) about the chemistry of baking cookies.
* Ask students to make a list of the key terms they hear as they watch the video. These terms will be added to the word wall.
* Once the video is over, have a brief discussion to debrief the main points.
* Students will work with a partner to create a tip card for baking cookies. Using an index card, students will make a list of the key tips to remember about how cookies are made.
	+ Each student will make their own cards, but they can work with a partner to share and recall information from the video.
* Students will use these cards for the duration of the project.

**Closing** - *(Designed to promote the retention of knowledge through the use of engaging strategies designed to rehearse and practice skills for the purpose of moving knowledge into long-term memory.)*

* Provide each student with the weekly Exit Ticket handout Appendix 2
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What characteristics of a cookie make it unhealthy?”

* Collect the Exit Tickets as students exit the classroom

**Day Two**

**Key Question of the Day**: (Project Roll-out) Do you understand our project?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “Is the Cookie Monster setting a bad example? Why or why not?”

**Learning Objectives**

As a result of this lesson, students will be able to:

* Describe the purpose of the project.
* List the tasks and products related to the project.
* Describe the project in one sentence.

**Required Materials for Daily Lesson**

* Computers
* Internet
* All rubrics – Appendix 13, 14, 15, 16 – One per student
* Engagement Scenario and Essential Question – Appendix 3 – One per student
* Project Management Log – Appendix 4 – One per student
* Post-It notes
* Highlighters
* Cookie dough package or label
* Video – Sesame Street Cookie Monster

**Estimated Instructional Time:** One, 50-minute class period

**Opening** – 5 minutes

* Prompt students with the concern many parents have voiced about the cookie monster as a character on a children’s TV program.
* Read the Bell-Work question and solicit responses from the students.
* Explain that, “Many parents have voiced their concerns about the Cookie Monster, a character on a popular children’s TV program.”
* Show the video about the Cookie Monster (in the “Video” folder).
* After the video (about 2 minutes) give students an opportunity to explain their responses to the situation of the angry parents.
* Use these responses to segue to the cookie ingredients and responses to the “unhealthy cookie” question from the previous day. Share some of the responses from the Exit Tickets that were collected yesterday.
	+ Give students an opportunity to ask questions or voice opinions.
* Transition by saying, “This project is going to take us on the journey of discovering how to make a healthy cookie.”

**Middle** – 40 minutes

* **Teacher TIP!** Students will create a portfolio at the end of the project (on the last day) where they will compile the bodies of evidence they have created throughout the project. Remind students to save important artifacts as they complete different tasks throughout the project. Feel free to determine the best way for students to create their portfolios based upon your particular situation (e.g., if your school/district has any specific requirements, etc.).
* Show the cookie dough package to the class.
* Ask students to think back to yesterday’s discussion about the cookie ingredients.
	+ The list of ingredients should still be posted in the room.
* Students should compare the ingredients in the packaged cookie dough to the individual ingredients.
	+ Ask students to determine what is the same and what is different about the ingredients.
* After students share their responses, ask the class which version would be healthier, the prepackaged or the made from scratch.
	+ If they say that the made from scratch cookies seem healthier, ask them to explain why.
		- Possible responses may include: packaged cookie dough has extra ingredients that the made from scratch don’t have like additives, etc.
	+ Then, have them share why they think people would buy the prepackaged cookie dough if it isn’t as healthy.
		- Possible responses may include: convenience, they taste better, they come out better compared to homemade, etc.
* Ask students to turn to their neighbor and discuss the following question, “Why do we need to create a recipe for a healthier cookie?”
	+ This should tie into a brief discussion about health and nutrition.
* Explain that, “We’ve all had sweets, like cookies, that are supposed to be healthy but really don’t taste good at all. The goal of our project will be to beat the odds and create a healthy cookie that tastes great.”
* Provide students with copies of the essential question and project scenario (Appendix 3).
* Provide students with copies of all rubrics.
* Give each student a Post-It note and a highlighter.
* Students should read the essential question and project scenario.
	+ They should write any questions or reactions to the project on the Post-It note.
	+ They should use the highlighters to highlight any terms or phrases for which they would like more information.
* Students should find a partner and share their Post-It notes and highlighted information with each other to try and answer each other’s questions.
* Bring the class back together. Have a discussion about the project, review the rubrics, and address any questions the students still have.
* Assign project teams. These will be the teams that students work with for the duration of the project.
* Distribute Appendix 4 and have students set up their project management logs, which they will use to document tasks throughout the project.
* Have each team create a name and design a logo/graphic that represents their team. The logo should incorporate their team name and any components of the project they wish to emphasize.
* Teams should share their logos and post them around the room.
	+ If time permits, have a gallery walk so that students can see each other’s logos.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“Summarize the project in one sentence.”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Three**

**Key Question of the Day**: How do we make sugar cookies?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet – Appendix 1
* “List three key points to remember for conducting reliable research.”

**Learning Objectives**

As a result of this lesson, students will be able to:

* Describe the ingredients of sugar cookies.
* Describe the baking process for sugar cookies.

**Required Materials for Daily Lesson**

* Computers
* Internet
* Cook books

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Lead a quick discussion to review how to conduct reliable research and the importance of documenting sources of information.
* Explain that, “Our goal today will be to research and select a standard sugar cookie recipe. Keep your notes in your research journal. These notes will form the basis for the research report that each team will write and submit at the end of the project.”

**Middle** – 40 minutes

* Share Research Journal guidelines:
* Date each entry
* Take clear notes
* Cite references in detail
* Share research report format with the students:
* Title Page. Identify the group members, project, dates and timeframe – “*How to Bake Healthier Sugar Cookies That are Still Palatable*”
* Summary or Abstract (Executive Summary)
* Nomenclature. Students need to list and define all terms and measurements used in the report.
* Introduction. This should include the entire project description.
* Theory and Analysis – *Why did we do this? Why is this a significant problem?*
* Experimental Procedures – *Sensory Evaluation Design/t-test*
* Results and Discussion – *Data analysis and sources of error. How would you improve the process?*
* Conclusions and Recommendations
* Acknowledgments
* Literature Cited
* Appendix
* **Teacher TIP!** Be sure to remind students that as they are finding information to add to their research journals, they should be dating each entry, taking clear notes, and citing all references in detail.
* Working with their teams, students will use the Internet and cookbooks in the classroom to find a recipe for sugar cookies that makes about a dozen cookies. Students should note all details – ingredients, amounts, temperatures, times, number of cookies, etc.
* This should take about 25 minutes (or less).
* All students in the team should agree on one recipe, but they’ll all document the information independently in each of their research journals.
* **Teacher Tip!**  Make clear that for the original recipe that students can find/bring their own - if they have a family favorite, or they find one online or in a cookbook, they can use that.  It will give a little more ownership for the original recipe cookie.
* Remind them to include the source for where the recipe was found.
* Students should write a couple of sentences to explain why this was the selected recipe.
* Once each team is finished, transition by providing each team with a problem:
* Part of a recipe calls for ¼ cup warm water, 1 ½ cups lukewarm milk, 1 tsp of salt, and 1/3 cup shortening. This recipe prepares enough for 18 portions. How much should the amount of each ingredient be changed if we prepared enough for 36 portions? How much should the amount of each ingredient be changed if we prepared enough for 27 portions? Show work and explain why you did what you did.
* Students will turn this prior to leaving.
	+ **Teacher TIP!** This will be the ratio pre-test to assess the level where students are with this type of math. Use this to gauge how to proceed with teaching the math portion of the project.

**Closing** – 5 minutes

* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

 “What aspect of baking the cookies are you most excited about? Why?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Four**

**Key Question of the Day**: How do we adapt recipes for varying numbers of servings?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet – Appendix 1
* “How many cookies does your recipe make? What would you have to do to double the number of cookies the recipe makes?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Use ratio and proportion to adjust recipes for varying numbers of servings.

**Required Materials for Daily Lesson**

* Recipe – Appendix 5 – One per student

**Estimated Instructional** **Time:** One 50-minute class period

**Opening** – 10 minutes

* Read the Bell-Work question and solicit responses from the students.
* Use this opportunity to answer any questions and to review how to calculate ratios.
* Return problems from previous day with any notes or comments.
* Allow students to review these notes and their work. Students should correct any mistakes they made.
* Students should meet with their team to discuss.
* Have a volunteer from each team share their strategies for solving the math problem.

**Middle** – 35 minutes

* Explain that, “This type of problem is termed a ratio and proportion problem. When two ratios are equal, the expression becomes a ratio and proportion. When changing the recipes, we want the ratios of ingredients to be the same, but the amounts will change.”
* Share this example:
	+ If one recipe serves 12 people, then we must add ingredients in order to serve 24 people. However, the ratio (the relationships among ingredients) of ingredients must stay the same, otherwise the flavor will change.
* Walk the class through this example:
	+ If a class has 30 students and 30 desks, the ratio of students to desks is 30/30. This expression could be reduced to 1/1 (this could also be written 1:1 or 1 to 1).
	+ If we add ten students to the class, then we must add desks in the same ratio, 1:1. A way to approach the problem is to set up the two ratios as equal, since we want the ratios to remain the same.
	+ 30 students/30 desks = 40 students/ x desks
	+ Since the ratios are equal, if we cross multiply, those products will be equal.



* Practice together as a class by working the first problem for the class (on board or projected):
* 90 grams butter/18 portions = x grams/ 36 portions
* 3 grams/18 portions = x grams/36 portions
* 15 mL/18 portions = x mL/36 portions
* Provide opportunities for questions and discussion.
* **Teacher TIP!** Have students practice calculating the ratios with the recipes they found earlier within their teams.
* Have at least one team share their work.
* Provide time for questions or discussion.
* Explain that, “When we adjust recipes for baking, we use the simple ratio method you’ve already used to adjust the amount of flour in the recipe but we adjust all of the other ingredients based on their relationship with the flour. Once we’ve adjusted the flour to double a recipe, we have to adjust all of the other ingredients using the ratio $\frac{Original amount ingredient}{Original amount flour} x\frac{x}{New amount flour}$ and solve for x where x = the new amount of the ingredient. Cross multiply ($\frac{original recipe butter}{original recipe flour}$ x $\frac{x}{twice the original recipe flour}$) and solve for x where x = the amount of butter in the scaled up recipe.”
* Distribute a clean copy of the original recipe (Appendix 5) to each student.
* Students will go through the recipe for the original cookie and calculate the amount of each ingredient needed for the new recipe using the ratio method.
* Assign some students different amounts of cookies to make so that you have several examples to work through on the board when students finish.
* Monitor progress and address issues as they arise.
* Have students post a few on the board when they finish and check them as a class.

**Closing –** 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“Why would a cook or baker need to know how to adjust recipes? How do you think these skills will help in our project?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Five**

**Key Question of the Day**: Why do sugar cookies have the ingredients they have?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What role do ingredients play in a recipe?”

**Learning Objective**

As a result of this lesson, students will be able to:

* List the ingredients in a sugar cookie by food group.
* Characterize each food group (chemical make-up, caloric content, form at room temperature, etc.)
* Explain the role of each ingredient in the baking process.
* Explain how the ingredients change during baking.

**Required Materials for Daily Lesson**

* Internet
* Computers
* Flip charts
* Markers
* Purpose of Ingredients – Appendix 6 – One per student

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Possible responses may include:
* To make the food taste good
* To give it a specific texture or flavor
* To make it nutritious
* Explain that, “To help us determine what we can change about our cookie recipes to make them healthier, we are going to investigate the ingredients of sugar cookies, what these ingredients provide, and how they change during the baking process.”

**Middle** – 40 minutes

* Ask the class to, “Think back to the video we watched about the science of baking. You probably recall the video discussing the importance of the chemical reactions that occur during the baking process. Well, without heat and water, those reactions won’t happen and you’ll be left with a pile of dough. The ratios of ingredients play a role in this too, because if you add too much or too little of certain ingredients, you won’t get the desired result, meaning the cookie may not have the right flavor or texture consistency. Let’s start by examining the scientific role of ingredients in baking.”
* Divide the class into the following teams:
	+ Strengthens or Toughens
	+ Weakens or Tenderizes
	+ Moistens
	+ Dries
	+ Leavens
* On a sheet of flip chart paper, create a master matrix template that looks like this (add additional spaces since there will be more than 3 ingredients):

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Ingredient | Strengthens or Toughens | Weakens or Tenderizes | Moistens | Dries | Leavens |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

* Each team will research their ingredient role and when they find the answers, they will come to the master matrix, list the ingredient and place an “X” in the column for the role, like in this example:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Ingredient | Strengthens or Toughens | Weakens or Tenderizes | Moistens | Dries | Leavens |
| Eggs | X |  |  |  |  |
|  |  |  |  |  |  |
|  |  |  |  |  |  |

* + Some ingredients will have more than one role, like eggs (which also weakens or tenderizes, moistens, and leavens), and the students will hopefully find this information to be able to complete the matrix.
	+ **Teacher TIP!** See a complete list in Appendix 6 so that you can help fill in any blanks if students don’t find all of the answers.
* Once the table is complete, bring the class together and have a brief discussion about the findings and what the information means in terms of baking cookies.
* Fill in any missing information on the table that the students didn’t find.
* Ask the class, “So, why do recipes call for specific ingredients in specific amounts?”
	+ Ask volunteers to share their responses.
* Next, ask the class, “What happens to these ingredients during the baking process?”
* Each team should research the ingredients that they found for their category on the matrix. So, for example, if the category is “Strengthens or Toughens” and eggs and flour are under that category, those are the ingredients they should research.
* Give each team a clean sheet of flip chart paper and a marker. Teams will document their responses on the flip charts and hang them in the room near the matrix poster.
* Once everyone has found the answers, bring the class together and have a volunteer from each team share their findings.
* Explain that the class will be using this information to help with tomorrow’s tasks.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“List two new facts you learned about the role of ingredients in a recipe.”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Six**

**Key Question of the Day:** (Continuation of Day Five)Why do sugar cookies have the ingredients they have?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What is the nutritional role of the ingredients in your cookie recipe?”

**Learning Objective**

As a result of this lesson, students will be able to:

* List the ingredients in a sugar cookie by food group.
* Characterize each food group (chemical make-up, caloric content, form at room temperature, etc.)
* Explain the role of each ingredient in the baking process.
* Explain how the ingredients change during baking.

**Required Materials for Daily Lesson**

* Internet
* Computers
* PowerPoint (or other presentation software)
* Flip charts
* Markers

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Explain that, “Now that we know the scientific role of each ingredient, we’re going to explore the nutritional role of the ingredients.”

**Middle** – 40 minutes

* The task for each team will be to use their identified sugar cookie recipe to determine the following:
	+ The food groups involved in the recipe
	+ Relative caloric content (Cal/gram)
	+ Nutritional facts about each food group and the pros/cons of the ingredients
	+ Percentages of each food group in the recipe
	+ Purpose of each ingredient (use the information found the previous day)
	+ Changes that occur in each ingredient during the baking process (use the information found the previous day)
* Remember, our ultimate goal to make a healthier sugar cookie, so the goal it to understand why they are made like they are.
* Students will document this information in their research journals.
* Students should work in their project teams to locate, arrange, and analyze the information.
	+ In their teams, students can determine how to divide the tasks.
* After completing the research students will organize the data/information into a presentation to share with the other teams.
	+ Students may use a PowerPoint format (or some other electronic format that’s compatible with the available technology) or posters.
	+ Limit your sharing presentation to no longer than 5 minutes.
* The goal of team sharing is to ensure that research was complete and to ensure that all information is accurate. In a positive research institution, the culture is both sharing and competitive.
	+ **Teacher TIP!** Remind students that if they have found any information on recipe substitutes through their research, they shouldn’t share that information with the class since that will come up later in the project and should be kept confidential.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What is the healthiest ingredient in your cookie? The least healthy? Why?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Seven**

**Key Question of the Day:** (Continuation of Day Six)Why do sugar cookies have the ingredients they have?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What are the characteristics of an engaging presentation?”

**Learning Objective**

As a result of this lesson, students will be able to:

* List the ingredients in a sugar cookie by food group.
* Characterize each food group (chemical make-up, caloric content, form at room temperature, etc.)
* Explain the role of each ingredient in the baking process.
* Explain how the ingredients change during baking.

**Required Materials for Daily Lesson**

* Internet
* Computers
* PowerPoint (or other presentation software)
* Flip charts
* Markers
* Cookie Ingredients Presentation Rubric – Appendix 7 – One per team

**Estimated Instructional** **Time:** 50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Review the characteristics of an engaging presentation.
* Use this opportunity to also review the characteristics of a good audience.

**Middle** – 40 minutes

* Give the class a bit of time to meet with their teams and add any finishing touches to their presentations.
* Each team will give their presentations.
* During the presentations, students in the audience should take notes in their research journals.
* Feel free to use the rubric (Appendix 7) to score the presentations.
* Debrief the presentations by having a discussion with the class to review the importance of the cookie ingredients.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What is the most interesting fact you learned about the cookie ingredients?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Eight**

**Key Question of the Day**: Which contains more calories – fats or sugars?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What are calories? Why should we pay attention to the number of calories we consume?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Describe how caloric content of foods is determined.
* Compare the caloric content of fat to sugars.
* Determine sources of error in an experimental procedure.

**Required Materials for Daily Lesson**

* Calorie Lab – Appendix 8 – One per student
* Lab materials for each team:
* Peanuts
* Sugar candy or sugar cube (marshmallows work well too)
* Water
* Test tube
* Clamp
* Stand
* Paper clip
* Electronic balance
* Thermometer
* Bunsen burner (if you don’t have a Bunsen burner, matches or a lighter will work)

**Estimated Instructional** **Time:** 3,50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* A calorie is a unit of energy in food.
* Explain that, “Today we will investigate the caloric content of fats and sugars in order to gauge why both can be a concern in our diets.”

**Middle** – 40 minutes

* Use Appendix 8 as a handout for the activity.
* If lab safety has not been addressed in previous activities, this would be a good time to review key safety rules.
* Review the activity with the students indicating that their procedure must be approved and that they have two days to complete the lab procedure and complete their report.
* The key question students will be answering in the lab is, “Which contains more calories, fat or sugar (carbohydrates)? How much energy is stored in a peanut and in sugar?”
* Once the students are in their teams, give them time to review the “Discussion” section of Appendix 8. Then, bring the class back together and quickly discuss the key points.
* Have the lab materials out and ready for students to bring back to their tables.
* Review the instructions on Appendix 8.
* Ensure that students have time to put away their materials before the end of class.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What do you have left to do for the lab? What data do you still need to collect?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Nine**

**Key Question of the Day**: (Continuation of Day 8) Which contains more calories – fats or sugars?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “How do we know how many calories are in food?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Describe how caloric content of foods is determined.
* Compare the caloric content of fat to sugars.
* Determine sources of error in an experimental procedure.

**Required Materials for Daily Lesson**

* Calorie Lab – Appendix 8 – One per student
* Lab materials for each team:
* Peanuts
* Sugar candy or sugar cube (marshmallows work well too)
* Water
* Test tube
* Clamp
* Stand
* Paper clip
* Electronic balance
* Thermometer
* Bunsen burner (if you don’t have a Bunsen burner, matches or a lighter will work)

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Conduct a quick status check and remind students of time limitations.

**Middle** – 40 minutes

* Give students the rest of the class period to finish their experiments and data collection.
* Once the labs are finished, students should put their supplies away and focus on the write-up of the research report.
* Debrief the lab by bringing the class together and have each team share a 30-second summary of their research design and findings.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What have you learned about nutrients in food, such as fat and sugar?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Ten**

**Key Question of the Day**: How can we make our cookies healthier?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “How can you make a healthier sugar cookie?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Determine alternative ingredients for their sugar cookies.
* Develop a “new” healthier recipe.

**Required Materials for Daily Lesson**

* Internet access
* Computers

**Estimated Instructional** **Time:** One 50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Possible responses may include:
* Substitute an ingredient such as butter, change white flour to wheat flour, etc.
* Add something “healthy” like dried fruit or nuts
* Substitute oil for applesauce or mashed banana
* “Today, our goal is to find a way to change your cookie recipe to make it healthier.”

**Middle** – 40 minutes

* **Teacher TIP!** They key here is that we are asking students to “change” the recipe. This means they have the freedom to substitute ingredients, add ingredients, or even take out ingredients (which wouldn’t be recommended). But, based upon the research that has been done to this point, students should have a solid understanding of the role of cookie ingredients and why they are used, so that information should help in their research specifically for ingredients to substitute, like substituting applesauce for oil. While students are working on their research, walk around the room to see if they need any help making the connections between what they’ve learned and the goal for today. A simple conversation can help steer them through this thought process without you specifically giving all of the information away.
* **Teacher Tip!**  Providing a budget to the students, or limitations on the ingredients list, is perfectly acceptable.  Suggestions for this may include:  must be available at the local grocery store, recipe must be under $25, each ingredient must cost less than $5, etc.
* **Teacher Tip!**When baking day arrives, feel free to expand to allow for multiple trials (see **Teacher Tip!** On day 15). It’s up to you if you want to put restrictions on the # of ingredients that the students are allowed to change in each “trial” recipe.  Ex:  groups can change 1 ingredient per trial, or up to 3 ingredients per trial, etc.  Advantages to that are less time spent, less chance for massive failure and lower cost of ingredients, but the disadvantages can include less exploration, less data from sensory evaluations, and healthier cookies that are very similar to each other even with multiple groups.
	+ Another way to handle this could be “assigning” each group of students to change one particular type of ingredient.  Draw from a hat or randomly assign:  Group A changes the sugar/sweetener, Group B changes the flour, Group C changes the oil/butter, etc.
* **Teacher Tip!** Make clear that for the original recipe that students can find/bring their own - if they have a family favorite, or they find one online or in a cookbook, they can use that.  It will give a little more ownership for the original recipe cookie.
* Students can make more than one change to the recipe. However, for each change they make, they need to research the nutritional value of the changed ingredient and explain why their team decided to make that change. If they are adding an ingredient, they must include how much of the ingredient is being added. For example, if they decide to add raisings, how many raisins (e.g., 1 tablespoon, ½ cup, etc.).
	+ This could be done in a table format if it’s easier to organize the information.
* All of this data should be recorded in their research journals.
* By the end of the class period, each team should have a healthier cookie recipe.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“How did you change your recipe and why?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Eleven**

**Key Question of the Day**: What is a sensory evaluation?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What attributes do you look for in the perfect cookie (e.g., taste, texture, etc.)?

**Learning Objective**

As a result of this lesson, students will be able to:

* Define sensory evaluation.
* Develop a sensory evaluation protocol.

**Estimated Instructional** **Time:** One50-minute class period

**Required Materials for Daily Lesson**

* Internet access
* Rulers
* Markers
* Flip charts
* Computer with Excel (or other data organization program) for each group
* Food service gloves
* Paper plates – Two per student
* Crackers
* A commercial cookie and its healthy alternative
* **Teacher TIP!** Before class, prepare plates for a sensory evaluation. Each student will receive two plates, one labeled “A” (or some other labeling system you’ve devised) the other labeled “B.” Put the alternative cookies on plates labeled “A” and the original recipe on plates labeled “B.” How you label the plates and which goes on each does not matter as long as it is consistent. Be sure to keep track of this so you don’t forget, and keep the answers hidden from the students. The cookies can be any type of variation, regular Oreo’s and reduced fat Oreo’s, for example. Other variations could be fat free, store brand, sugar free, etc. the combination doesn’t matter as long as a control (the name brand original version) is used. The goal is to identify differences in the cookies. For a first-time sensory evaluation, Oreo’s are a great cookie to use because the differences between reduced fat and regular are very easy to detect. The filling in the regular will be a different color and texture from the reduced fat, and the cookies are a noticeably different color.

**Estimated Instructional Time:** One50-minute class period

**Opening –** 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Create a class list of cookie attributes on a sheet of flip chart paper: likes, dislikes, what would make the cookie better? Possible responses may include:
* Crunchy
* Chewy
* Soft
* Cake-like
* Sweet
* Give each team a sheet of flip chart paper and a marker. Ask students to organize the list into categories.
* Students post their lists around the room and view each other’s posts.
* Explain that, “Depending on the food item, there are specific attributes the food should have in order for it to be palatable and desired by consumers.”
* Share the definition of palatable.
* According to Merriam-Webster, palatable means “agreeable to the palate or taste.”
* Explain that, “Today we are going to learn the fundamentals of sensory evaluation, which we’ll use later in the project to evaluate your new cookie recipes.”

**Middle** – 40 minutes

* Explain the components of a sensory evaluation.
* According to the Institute of Food Technologists, a sensory evaluation is “A scientific discipline used to evoke, measure, analyze, and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste and hearing. In a food company, sensory scientists work closely with product developers to understand what consumers like and why, and if consumers can tell a difference when they change a product (e.g., substitute an ingredient).”
* Give each student the two cookie samples and some crackers.
* Walk students through the steps of conducting a sensory evaluation:
	+ Eyes – Start by looking at the cookies. Compare each cookie. What are the physical differences, if any?
	+ Nose – Smell the cookies. Can you smell any differences? If so, what smells different?
	+ Touch – Touch the cookies. Do they feel different? If it’s an Oreo, for example, touch the cream filling in each cookie. Do they feel different? Break the cookies. Are there differences in the texture?
	+ Taste and Sound – Take a small bite of one cookie. Observe the flavor, texture, and listen for the sound of the cookie as you bite into it and chew it. When you’re done with the first sample, take a bite of a cracker to cleanse your palate. Then, repeat with the second sample.
	+ When they are finished with all of these steps, they can eat the cookies.
* As you go through each step of the sensory evaluation, have students write down their reactions at each phase in their research journals.
* After they have tested each sample, ask them to share their thoughts about each stage and the differences they noticed. Then, ask them to share what they think is different about the cookies and reveal the answers.
* Transition by explaining that students just completed a discrimination test, which answers the question, “Which one is different.” This type of test can also be done with three samples, and that would be called a triangle test, where two samples would be the same and one would be different.
* Students will now research different sensory evaluation tools.
* **Teacher TIP!** Other methods of sensory evaluation include (but don’t reveal these to the students, this is just for your information as students conduct their research):
* If you are trying to determine how products are different, *if* they are different, a descriptive analysis test is done. While this test is time consuming, it results in a lot of data. The panelists will use a t-test to determine if means are statistically different. We’ll be learning more about that later.
* If you are trying to determine the acceptability of a product, if one is preferred over the other, use an affective/hedonic test (also known as consumer acceptance test). This will help developers understand if people like the product, but it may be difficult to get a representative sample.
* Based on their research, students will develop a sensory evaluation instrument to use when they test their own cookies. This instrument must utilize a measurement scale that will provide quantitative (numeric) data that students can analyze.
* **Teacher TIP!** The PowerPoint “Sensory Evaluation” (in the “Additional Resources” folder) is an additional resource to help students through this process. Have students work in their teams to develop the instrument and then create them as Word Documents (or other electronic format that compatible with available technology).
* **Teacher TIP!** Depending upon how long it takes to get through the sensory evaluation, the research part could either start in this class period and carry over to the next day, or it could be introduced and start the next day.
* Directions for developing the instrument:
	+ List all important characteristics of the cookie that you want the participants to evaluate (since each team knows what they’ll be changing about their cookies, this list should be easy to make)
	+ Narrow the list to the 5 most important items
	+ Develop a scale to measure each characteristic from one extreme to another
		- For example, chewiness goes from too chewy to too crunchy.
	+ Draw a 10cm line and place the extremes at either end of the line
	+ Repeat for all characteristics

**Closing –** 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“Why do we conduct sensory evaluations?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Twelve**

**Key Question of the Day**: (Continuation of Day Eleven) What is a sensory evaluation?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What questions do you have about the research you’re doing on sensory evaluation instruments?

**Learning Objective**

As a result of this lesson, students will be able to:

* Define sensory evaluation.
* Develop a sensory evaluation protocol.

**Estimated Instructional** **Time:** One50-minute class period

**Required Materials for Daily Lesson**

* Internet access
* Rulers
* Markers
* Flip charts
* Computer with Excel (or other data organization program) for each group
* Food service gloves
* Paper plates – two per student
* Crackers
* A commercial cookie and its healthy alternative

**Estimated Instructional Time:** One50-minute class period

**Opening –** 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Use this opportunity to answer questions and assess progress.

**Middle** – 40 minutes

* Students will continue their research and development of sensory evaluation tools. After students complete their research and develop an instrument, compile a master file with the instruments from each team.
* Review the instruments as a class, compare similarities and differences, and create one instrument based on the contributions from each team. This final result will be the instrument that’s used for each team to test their cookies.
* By creating a class instrument, there will be some consistency in the results of the sensory evaluations for the different cookies.
	+ **Teacher TIP!** Keep in mind that when it’s time to bake the cookies and do the sensory evaluations, you’ll have to bake a batch of cookies using the original, unaltered sugar cookie recipe, which will serve as the control. So, participants will be conducting a discrimination test to determine what’s different about the cookies and which one they like better.

**Closing –** 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“How do you know our instrument will give us good data?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Thirteen**

**Key Question of the Day**: What statistical concepts are needed for analyzing a sensory evaluation?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What are statistics?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Perform a paired t-test (or appropriate application).
* Interpret statistical results and draw conclusions.

**Estimated Instructional** **Time:** One50-minute class period

**Required Materials for Daily Lesson**

* Math Lesson – Appendix 9 – One per student
* Math Pre-Test – Appendix 10 – One per student
* Traditional Math Problems – Appendix 11 – One per student

**Estimated Instructional Time:** One50-minute class period

**Opening –** 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Share the definition of statistics:
	+ According to Merriam-Webster, statistics is “a branch of mathematics dealing with the collection, analysis, interpretation, and presentation of masses of numerical data.”
* Explain that, “Today, we are going to explore statistical concepts that will help us understand how to analyze the data form our sensory evaluations.”

**Middle** – 40 minutes

* Give each student a copy of Appendix 10.
* Give students about 10-15 minutes to complete the pre-test.
* Collect the pre-tests and review them while students work on the next exercise (Appendix 11).
* Students will work in pairs to complete this exercise.
	+ If they work in teams of 4 for their main project teams, they could split into teams of 2 for this exercise.
* Students will have the rest of the class period to complete the exercise.
* If students finish before the end of the class period, bring the class back together for a review discussion.

**Closing –** 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What are two new statistics concepts you learned?”

* Collect the Exit Ticket for the day as students leave the classroom
* Give students Appendix 10 for homework.

**Day Fourteen**

**Key Question of the Day**: How do we determine which cookies people prefer?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “Summarize the process of a sensory evaluation?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Use a sensory evaluation protocol in a pilot test.
* Perform a paired t-test (or appropriate application).
* Interpret statistical results and draw conclusions.

**Required Materials for Daily Lesson**

* Rulers
* A computer with Excel for each group
* Food service gloves
* Paper plates – Two per student
* Same cookies as used on the previous day
* Crackers
* Sensory Evaluation Presentation – “Additional Resources” folder

**Estimated Instructional** **Time:** One 50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Use this opportunity to review the process of conducting a sensory evaluation.
* Explain that, “Today we will perform a pilot test of our sensory evaluation using the same commercial cookies.”

**Middle** – 40 minutes

* Take a few minutes to review the homework.
* Answer any questions and review the answers with the class.
* Collect their papers at the end of the review.
* Transition to the Sensory Evaluation Presentation (in the “Additional Resources” folder) and review the key points about creating a hypothesis, data collection, and analysis.
* Distribute the cookies and crackers to the students.
* In their teams, students will conduct the sensory evaluation, collect and analyze the data.
* Each team should write a summary of their findings.
* If time permits, bring the class together and discuss the results of the pilot test.
	+ **Teacher TIP!** At this point, you should begin planning for the sensory evaluation when the cookies are baked. You’ll need to find a guest to join the sensory evaluation panel. The guest could be a baker or someone from the food industry who would be willing to participate. You’ll also need to determine who will participate in the panel and where on campus it will take place. One option is to do it during lunch, where faculty and staff could come to the cafeteria to participate. Or, participants can just come to your classroom. Be ready by Day Sixteen.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What will you do differently when you conduct the sensory evaluation again? What changes will you make?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Fifteen**

**Key Question of the Day**: How do we bake cookies?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What food safety rules will you follow today?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Bake cookies following a recipe.
* Demonstrate food and lab safety protocol.

**Required Materials for Daily Lesson**

* Cooking lab/supplies
* **Teacher TIP!** If a cooking lab is not available, cookies could be baked using toaster ovens.
* All cookie ingredients for each team

**Estimated Instructional** **Time:** One 50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Have a discussion about food safety protocol as students are sharing their responses.
* Remind students of the key rules and procedures to follow when working in a kitchen and preparing food.
* Explain that, “Today, we will be baking our modified cookie recipes along with a batch of the original cookie recipe.”

**Middle** – 40 minutes

* Use the entire class period for baking the cookies.
* **Teacher Tip!** If you want to allow more days for baking, such as allowing 3 trials to get the “ideal” healthier cookie, then do so. Or allow students to bake at home, if time is tight, if they want to do multiple trials. This does take more time but might allow for more investigation for the students and deeper discussion of what healthier/alternative ingredients will do to the original cookie. Remember: each trial MUST have a sensory evaluation!

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“How do you think your cookies turned out?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Sixteen**

**Key Question of the Day**: Which cookie do people prefer?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “How will we know if the cookies are different?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Use a sensory evaluation protocol.
* Perform a paired t-test.
* Interpret statistical results and draw conclusions.

**Required Materials for Daily Lesson**

* Food service gloves
* Paper plates – Two per student
* Baked cookies – Original recipe and modified recipe
* Guest speaker (Baker or other food industry representative)
* Sensory evaluation instrument – Appendix 12 – One per participant

**Estimated Instructional** **Time:** One 50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Explain that, “Today, is the day the panel will test our cookies!”

**Middle** – 40 minutes

* As participants come to conduct the sensory evaluation, give them a copy of Appendix 12 to record their data.
* Since there will be a number of cookies to sample depending on the number of teams, as the teacher, you can determine who will sample which cookies. Obviously, there won’t be enough for everyone to sample every cookie. They will just need one cookie of the original recipe and one modified cookie.
* Be sure the participants don’t have any food allergies.
* As participants finish, collect their handouts.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“Why do we need to collect a lot of data? Why can’t we just ask a few people?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Seventeen**

**Key Question of the Day**: What does our data indicate?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What must be included in your presentation? List the information required.”

**Learning Objective**

As a result of this lesson, students will be able to:

* Analyze data and draw conclusions.

**Required Materials for Daily Lesson**

* Computer
* Spreadsheet (MS Excel or similar program that is available)

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Remind students that they are preparing a report and presentation.
* Re-acquaint them with the research report elements and the rubrics for the report and the presentation that were presented earlier in the project.
* Explain that, “Today is a time to review your notes, organize your data and begin writing your report.”

**Middle** – 40 minutes

* Students will have the rest of the class period to work in their teams to develop their research reports and presentations.
* Since all of the records were kept in their research journals, at this point, it will be a matter of compiling and organizing the information into the report format.
* In their teams, students can determine who will work on which parts.
* Visit with each team and answer any questions.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What does your team still need to accomplish?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Eighteen**

**Key Question of the Day**: (Continuation of Day Seventeen) What does our data indicate?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What questions do you have about your research reports?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Analyze data and draw conclusions.

**Required Materials for Daily Lesson**

* Computer
* Spreadsheet (MS Excel or similar program that is available)

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Answer any questions students have about their projects.

**Middle** – 40 minutes

* Students will have the rest of the class period to work in their teams to develop their research reports and presentations.
* Continue to visit with the teams to answer any questions.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What does your team still need to accomplish?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Nineteen**

**Key Question of the Day**: (Continuation of Day Eighteen) What does our data indicate?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “List the objectives for your presentation tomorrow.”

**Learning Objective**

As a result of this lesson, students will be able to:

* Analyze data and draw conclusions.

**Required Materials for Daily Lesson**

* Computer
* Spreadsheet (MS Excel or similar program that is available)

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Answer any questions students have about their projects.

**Middle** – 40 minutes

* This is the last day students will have to work in their teams to develop their research reports and presentations.
* Continue to visit with the teams to answer any questions.
* If students need additional time to finish their work, this can be done for homework.

**Closing** – 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“Are you ready for your presentations?”

* Collect the Exit Ticket for the day as students leave the classroom

**Day Twenty**

**Key Question of the Day**: Do the healthy alternative cookies taste differently than the original recipe?

Bell-Work (Each day the Bell-Work question should be prominently displayed and used to open the lesson)

* Provide students with the weekly Bell-Work sheet (Appendix 1)
* “What are we looking and listening for in your classmates’ presentations today?”

**Learning Objective**

As a result of this lesson, students will be able to:

* Discuss the results of a paired t-test and their implications.
* Make decisions based on the analysis of quantitative data.

**Required Materials for Daily Lesson**

* Projector
* Computers
* Project Presentation Audience Feedback Form – Appendix 13 – One per student per presentation
* Self-Reflection Form – Appendix 14 – One per student
* Collaboration Rubric – Appendix 15 – One for the teacher
* Project Rubric – Appendix 16 – One per team
* Guest speaker (Bakery reps, parents, faculty, administration, etc.)

**Estimated Instructional** **Time:** One50-minute class period

**Opening** – 5 minutes

* Read the Bell-Work question and solicit responses from the students.
* Have students discuss the essential pieces of the presentations to clarify expectations and develop focus.
* After the discussion, allow each group a few minutes to review their presentations and make final edits.
* When you call time, each group must have their presentation to you (emailed or on disk) before the presentations begin (so that students are focused on their classmates’ presentations not their own).”
* Welcome guests to the presentation.

**Middle** – 40 minutes

* Each team will deliver their presentations.
* Each student should complete a rubric for each presentation.
* Allow a few minutes for a question answer session following the presentations.
* Students will complete the self-reflection form (Appendix 14).
* Students collect their evidence for this project and add it to their portfolio with their captions and descriptions for each item.

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| --- | --- |
| **Item** | **Description** |
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**Closing –** 5 minutes

* Provide each student with the weekly Exit Ticket handout Appendix 2.
* Students will turn in their Exit Ticket for that day. They will respond to the following prompt:

“What changes made a healthier cookie that people actually wanted to eat?”

* Collect the Exit Ticket for the day as students leave the classroom
1. <http://www.reuters.com/news/pictures/slideshow?articleId=USRTXT3DK#a=1> - Reuters.com [↑](#footnote-ref-1)