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| **TEXAS CTE LESSON PLAN**[www.txcte.org](http://www.txcte.org) |
| **Lesson Identification and TEKS Addressed** |
| **Career Cluster** | Hospitality and Tourism |
| **Course Name** | Food Science |
| **Lesson/Unit Title** | The Scientific Method of Lab Investigation |
| **TEKS Student Expectations** | **130.256. (c) Knowledge and Skills**(3) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micro pipettors, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures(G) analyze, evaluate, make inferences, and predict trends from data and(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports |
| **Basic Direct Teach Lesson**(Includes Special Education Modifications/Accommodations and one English Language Proficiency Standards (ELPS) Strategy) |
| **Instructional Objectives** | **Students will:*** Define science
* Identify the scientific method
* Judge reliability and create charts, diagrams, and graphs
* Participate in a lab investigation activity to become familiar with the scientific method
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| **Rationale** | Scientists have been solving problems for centuries using a type of system of investigation steps. This system is called the scientific method. It begins with a question, a possible solution – hypothesis, the experiment, analyzing the data and the conclusion. Let’s find out how to do this! |
| **Duration of Lesson** | Three 45-minute class periods |
| **Word Wall/Key Vocabulary***(ELPS c1a, c, f; c2b; c3a, b, d; c4c; c5b) PDAS II (5)* | **Control:** The standard against which you measure all changes**Experiment:** A scientific procedure undertaken to make a discovery, test a hypothesis or demonstrate a known fact**Hypothesis:** A possible solution to a problem**Question:** A sentence worded or expressed so as to elicit information**Reliability:** The ability to be relied on or depended on, as for having some foundation; based on truth**Scientific method:** A system of steps used to investigate, answer questions, and solve problems**Variable:** A factor that is being changed**Valid:** Accuracy, honesty, or achievementNote: Many other terms on the slide presentation can be identified. Encourage students to include the definition in the assignment. |
| **Materials/Specialized Equipment Needed** | **Equipment:*** Computer with projector for PowerPoint presentation
* Computers with Internet access (be sure to follow district guidelines for Internet access)
* Light projector (Elmo)

**Materials:**Various examples of:* Charts
* Diagrams
* Graphs
* Post-It® Notes

**Supplies:**For each lab group:* Bags, clear
* Small items of various colors (3 to 5).
	+ Buttons
	+ Candies (Gummy Bears, M&M’ s, Reece’s Pieces)
	+ Marbles
	+ Rocks

Optional:* Hot air popcorn poppers
* Large bowls (3)
* Pins
* Popcorn kernels (300)
* Copies of handouts

**PowerPoint:*** The Scientific Method of Lab Investigation
* Presentation Notes – The Scientific Method of Lab Investigation

**Technology:*** Free iPad App:
	+ The Scientific MethodA wonderful resource to reference all the formulas.<https://itunes.apple.com/us/app/the-scientific-method/id391282465?mt=8>
* Infographic:
	+ CDER’s Science and Research Programs InfographicWithin a science-based regulatory agency, such as the Center for Drug Evaluation and Research (CDER) at the FDA, the focus of science and research programs is to obtain knowledge that enhances the efficiency and consistency of the regulatory decision-making process. <http://www.fda.gov/Drugs/ScienceResearch/ucm319942.htm>
* Ted Talks:
	+ How simple ideas lead to scientific discoveries – Adam Savage

Adam Savage walks through two spectacular examples of profound scientific discoveries that came from simple, creative methods anyone could have followed — Eratosthenes’ calculation of the Earth’s circumference around 200 BC and Hippolyte Fizeau’s measurement of the speed of light in 1849.<http://ed.ted.com/lessons/how-simple-ideas-lead-to-scientific-discoveries>**Graphic Organizers:*** The Scientific Method for Food Science Experiments
* What is Science?
* What is Science? (Key)

**Handouts:*** Judging Reliability
* Lab Investigation Activity
* Note-Taking: The Scientific Method of Lab Investigation
* Popping Corn Lab Investigation Activity
* Rubric for Lab Investigation Activity
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| **Anticipatory Set**(May include pre-assessment for prior knowledge) | **Before Class Begins:**Display as many of the lesson-related supplies (see Materials or Specialized Equipment Needed) that you have available on a table in front of the room.As students enter the classroom, hand each student a Post-It® Note and ask them to write one food-related question they might have always wondered about.For example:* Why do bacteria grow on food at certain temperatures?
* Why do bananas turn brown?
* Why do oil and vinegar not mix?
* Why do we have to wash our hands before we eat?
* Where do germs come from? How do they multiply?

Ask students to share their questions and then ask them how they think scientists have solved some of them.The answer – lab investigation!Begin the discussion on the scientific method and how it works. |
| **Direct Instruction \*** | Introduce lesson objectives, terms, and definitions.Distribute the graphic organizer and handout What is Science and Note-Taking: The Scientific Method of Lab Investigation so that students may take notes during the slide presentation.Introduce the PowerPoint The Scientific Method of Lab Investigation and begin the discussion about how lab investigations will be conducted.View YouTube video:* The Scientific Method: Steps, Terms, and ExamplesIn order to gain knowledge about the world however the steps involved in thescientific method vary widely among the different scientific disciplines<http://youtu.be/BVfI1wat2y8>

Optional video related to this lesson:* Science Style (Gangnam Style Parody/Piggyback)Piggyback song to teach the scientific method using “Gangnam Style” by PSY.<http://youtu.be/MyFi6BQfDik>

*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** checking for understanding
* providing assistance with note-taking
 |
| **Guided Practice \*** | Place the handout Judging Reliability on the light projector and explain to the students about reliability.Assign a scribe who is familiar with creating charts and graphs on Microsoft® Word to count the show of hands from students for each number of reliability for each question. Ask your students to describe why they chose the number of reliability for the scenario.Ask the scribe to demonstrate how quickly and easily it is to create a chart or graph with data collected.Allow students to practice on computers using the same data.Note: Students may also hand draw charts and graphs if computers are not available.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** providing peer tutoring
* checking for understanding
 |
| **Independent Practice/Laboratory Experience/Differentiated Activities \*** | Introduce the following scenario to the students:You are a foodservice employee and your job is to count the number of items for packaging. New colors have been introduced for the season and you need to figure how to incorporate them into the package. What is the best way for you to collect the data you need to show your supervisor?Distribute the handout The Scientific Method for Food Science Experiments and instruct students to complete each section for the lab activity.Remind students of the following:1. No eating or drinking in the lab
2. Tie long hair back
3. Wear closed toe shoes
4. Wear a lab coat or apron
5. Wash hands before and after lab

Distribute Rubric for Lab Investigation Activity so that students will understand what is expected.Option: Additional lab investigation activity if time permits Popping Corn Lab Investigation Activity.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** assisting student in gathering information
* providing praise and encouragement
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| **Lesson Closure** | Review lesson objectives, terms, and definitions.Refer to the Post-It® Notes in the Anticipatory Set and instruct volunteer students to search for the answers from reliable sources such as:* Bad Bug Book (Second Edition)<http://www.fda.gov/downloads/Food/FoodborneIllnessContaminants/UCM297627.pdf>
* Centers for Disease Control and Prevention<http://www.cdc.gov/>
* Fightbac.org<http://www.fightbac.org/>
* Foodsafety.gov<http://www.foodsafety.gov/>
* U.S. Food and Drug AdministrationProtecting and Promoting Your Health<http://www.fda.gov/Food/FoodborneIllnessContaminants/default.htm>
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| **Summative/End of Lesson Assessment \***  | Students will be assessed with appropriate rubric.*Individualized Education Plan (IEP) for all special education students must be followed. Examples of accommodations may include, but are not limited to:** grading according to work done
* providing praise and encouragement
 |
| **References/Resources/****Teacher Preparation** | **Textbook:*** Mehas, K. Y., & Rodgers, S. L. (2002). *Food science: The biochemistry of food and nutrition.* New York, NY: Glencoe/McGraw-Hill.
* Ward, J. D., & Ward, L. T. (2013). *Principles of food science.* Tinley Park, IL: Goodheart-Willcox Company.

**YouTube:*** Science Style (Gangnam Style Parody/Piggyback)Piggyback song to teach the scientific method using “Gangnam Style” by PSY.<http://youtu.be/MyFi6BQfDik>
* The Scientific Method: Steps, Terms, and ExamplesIn order to gain knowledge about the world however the steps involved in thescientific method vary widely among the different scientific disciplines<http://youtu.be/BVfI1wat2y8>
 |
| **Additional Required Components** |
| **English Language Proficiency Standards (ELPS) Strategies** | * Write word wall on the board
* Students may create notecards for unfamiliar words and terms that they need additional help with
* Allow ESL students extra time to respond
* Encourage new learners of English to act out or draw pictures to get their meaning across
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| **College and Career Readiness Connection[[1]](#footnote-1)** |   |
| **Recommended Strategies** |
| **Reading Strategies** | Other articles pertaining to this lesson students may read include:* Synthetic Food: Better Cooking Through ChemistryJust as in art, music, dance, and literature, trends in cooking go in and out of vogue. The latest movement to sweep the world’s kitchens is molecular gastronomy, essentially the application of the scientific method to food preparation.<http://www.pbs.org/wgbh/nova/next/physics/synthetic-food-better-cooking-through-chemistry/>
* Want to Learn About the Scientific Method? Go Bake Some Cookies Bethany Brookshire, aka @SciCurious, is a blogger at ScienceNews, where she covers the latest science research and develops creative science outreach projects.<http://www.npr.org/blogs/thesalt/2014/09/17/348762526/want-to-learn-about-the-scientific-method-go-bake-some-cookies>
* U.S. Food and Drug AdministrationLaboratory Tests<http://www.fda.gov/medicaldevices/productsandmedicalprocedures/invitrodiagnostics/labtest/default.htm>

**Reading Strategy**Encourage students to connect reading to their life experiences or prior knowledge. |
| **Quotes** | If the facts are contrary to any predictions, then the hypothesis is wrong no matter how appealing. **-David Douglass**It is a good morning exercise for a research scientist to discard a pet hypothesis every day before breakfast. It keeps him young. **-Konrad Lorenz**Science never solves a problem without creating ten more.**-George Bernard Shaw** |
| **Writing Strategies****Journal Entries + 1 Additional Writing Strategy** | **Journal Entries:*** An experiment can be considered valid if…
* The scientific method can help solve problems by …
* Collecting data for the science experiment and being able to produce charts, diagrams and graphs is helpful because …

**Writing Strategy:**RAFT writing strategy is designed to demonstrate student understanding of material in a creative and relevant way.* Role – foodservice supervisor
* Audience – employees
* Format – memo
* Topic – introduction of new season colors to packaging on assembly line

The memo should detail the amount of new colors to be added to the packages according to data collected. |
| **Communication****90 Second Speech Topics** | * Three new things I learned about science are …
* Controlling the variables in a science experience is important because …
 |
| **Other Essential Lesson Components** |
| **Enrichment Activity**(e.g., homework assignment) | Create a T – chart of things that could be tested by science and things that would not fall under the umbrella of science, for example, opinion – which flower smells the best?**Infographics:**Infographics are graphic visual representations of information, data or knowledge intended to present complex information quickly and clearly.The infographic below is related to this lesson. Allow students to view the image on a projector and lead a discussion concerning the information provided.* CDER’s Science and Research Programs InfographicWithin a science-based regulatory agency, such as the Center for Drug Evaluation and Research (CDER) at the FDA, the focus of science and research programs is to obtain knowledge that enhances the efficiency and consistency of the regulatory decision-making process. <http://www.fda.gov/Drugs/ScienceResearch/ucm319942.htm>

**TED Talk:**TED-Ed’s commitment to creating lessons worth sharing is an extension of TED’s mission of spreading great ideas. This allows users to take any useful educational video, not just TED’s, and easily create a customized lesson around the video.The video below is related to this lesson. Allow students to view the video and lead a discussion concerning the TED Talk.* How simple ideas lead to scientific discoveries – Adam SavageAdam Savage walks through two spectacular examples of profound scientific discoveries that came from simple, creative methods anyone could have followed — Eratosthenes’ calculation of the Earth’s circumference around 200 BC and Hippolyte Fizeau’s measurement of the speed of light in 1849.<http://ed.ted.com/lessons/how-simple-ideas-lead-to-scientific-discoveries>
 |
| **Family/Community Connection** | Have students research food experiments and share the results with family and community members. Have them discuss the steps taken that make the data reliable. |
| **CTSO connection(s)** | **Family, Career, and Community Leaders of America (FCCLA)**<http://www.texasfccla.org>Food InnovationsIndividuals or teams demonstrate knowledge of the basic concepts of food product development by creating an original prototype formula, testing the product through focus groups and developing a marketing strategy. Participants must prepare a display, suggested product packing and an oral presentation. There will be a junior, senior, and occupational category |
| **Service Learning Projects** | Successful service learning project ideas originate from student concerns and needs. Allow students to brainstorm about service projects pertaining to lesson.<http://www.ysa.org/>Possible idea:Develop a pamphlet or brochure that describes an aspect of food innovation that could be distributed at farmers market. It should include charts, diagrams and/or graphs of data. |

1. Visit the Texas College and Career Readiness Standards at <http://www.thecb.state.tx.us/collegereadiness/CRS.pdf>, Texas Higher Education Coordinating Board (THECB), 2009. [↑](#footnote-ref-1)