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Salt and Health - It's not fair!

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Introduction

Imagine there is a child in your classroom who just will not sit still. You try everything you know to engage him, but the child is repeatedly zoning out. In frustration, you say to the child, “What’s going on? What is wrong?” He responds by asking to use the bathroom, again. Reluctantly, you agree to allow him because he seems like a well behaved young man. It’s troubling that he was missing so much of instructional time going to the restroom. Rather than penalizing the student or attributing to his lack of interest you dig deep and find out it is due to an underlying medical condition. You would later discover the student suffered with both type 2 diabetes and high blood pressure. Had you not been as empathetic, the situation could have become critical. Rather than sincerely talking to the student, the normal reaction could have been scolding. As a result, the child would have felt more stress, his heart rate would have increased, as would his blood sugar. Adolescents with chronic disease such as this student, struggle with day-to-day challenges. The symptoms this child feels are silent killers because not all high blood pressure can be prevented and this child will live with this disease for the rest of his life. Furthermore, relying on the science textbook to teach and learn about this disease is useless. Our current textbooks do not adequately teach about preventive health. In addition, many parents feel ill-equipped to educate their children on issues of health because of their own lack of knowledge. The goal of this unit is to increase the students’ health knowledge and promote positive mental and healthy behaviors towards his/her well-being.

Demographics

Kayenta Middle School serves grades 5-8; a part of Kayenta Unified School District #27 located on the most beautiful landscapes of the Navajo Nation, Arizona. Kayenta is a tight-knit community promoting school pride in recognizing students for their strong leadership and academic skills. Schools celebrate students’ achievements by hosting academic honor awards night, seasonal athletic banquets, and extracurricular activities like family nights, afterschool tutoring, family-fitness night, and parent/student involvement – conferences and site council meetings. In addition, the school takes pride for integration of Diné Culture, History, and Language to honor students’ tradition. Our middle school’s enrollment is about 508 for school

year 2016-2017. Most class sizes range from 23-28 students distributed among five general classrooms and one class compromising of the English Language Learners Program. The majority of students are Diné. More than half of the fifth-grade student-body read below grade level, some at grade level, and very few read above grade level.

Rationale

We hear it over and over again, “Your kids will imitate you!” I think why does this phrase matter? It matters because we teach by example and a child will learn by observing. For example, if we are modeling good eating habits, our children will see us using and consuming less salt and in turn, so will they. Providing young people the proper information they need to know about salt and teaching them how to make healthy choices is a major step to reducing cardiovascular diseases and many other chronic illnesses later in life. Therefore, it is pivotal to know about the harmful effects of a high-sodium diet.

In the past several decades, an epidemiologic study reported chronic diseases are on the rise among the Native American population. According to the broad studies, the Diné community is facing increasing numbers of individuals with diabetes, high blood pressure or hypertension, and other cardiovascular diseases.¹

I want to inform my fifth grade students of these health risks, diabetes mellitus type 2 and/or slightly high blood pressure (hypertension) that are trending among adolescents because it can affect the school population and my class. As a Diné educator, I can make an impact by teaching, modeling, and encouraging healthy eating habits with the importance of a daily exercise regimen, and emphasizing less sodium in the hope that healthy kids mature into healthy adults.

The Department of Plant and Environmental Sciences, New Mexico State University, reports health problems in the Navajo Nation with the population at a greater risk for developing diseases such as cardiovascular disease.²

This disease was very rare in the 1940’s among the Navajos, who are the largest Indigenous tribe in the U.S. After World War II, there was a time of growth for the U.S. while there was a land reduction on the Navajo Reservation. The ways of traditional food of Native American were impacted. Most Native Americans became dependent on commercially processed food from programs like the Commodity Food Program. The federal government may have provided generously to prevent starvation to fulfill an agreement from the Treaty of 1864. Factors such as low income, poor diet, and limited physical exercise are impacting their quality of life. In addition, the poor access to nutritious foods and the departure from traditional diets are associated with health problems, especially type 2 diabetes and obesity. Diabetes, along with obesity, are major concerns because of their increased occurrence among Navajo youth. Since 1996, there has been a fifty four percent increase in the diagnosis of Native American youth ages 15-19 for Type 2 Diabetes, a disease usually associated with adults. However, it is becoming a significant threat in Native American children and youth. Currently one of the Native American Tribes, the Pima, has the highest rate of diabetes in the world. On average, Native Americans’ risk of developing diabetes is 2.6 times more likely than non-Hispanic whites of similar age. Data also show 22.9 percent of Navajo adults 20 years of age and older are diabetics.³

There is also a strong link between diabetes and heart disease. Increased blood sugar is linked to

hypertension, dyslipidemia, and obesity. For this research paper, my focus is on hypertension and the importance of being aware of sodium consumption in the form of salt.⁴

This unit will fit into a two-week lesson with the activities aligned with Arizona College and Career Ready Standards – Science. The unit is built around strong content knowledge and integrating Physical Science and Health Education. The model for science integration provides an understanding of science concepts and principles linked to real life situations, along with activities applying an inquiry approach and making teaching interactive – teaching students the process of observing, predicting, investigating, and explaining, comparing and contrasting, measuring, formulating hypotheses, controlling variables, experimenting, gathering and interpreting results.

What is salt?

Chemical Composition

In chemistry, salt is defined as an ionic compound forming from a reaction of acid and base or alkali that neutralizes the acid. In the solid form, salts have a neutral charge. Sodium chloride forms from ionic bonding of sodium and chlorine ions. Eboch describes the table salt as one sodium cation (Na^+) for every chloride anion (Cl^-). Therefore, the chemical formula of NaCl is formed.⁵ In 1807, Sir Humphrey Davy took apart salt and revealed sodium and chlorine. Manufacturing industries thrive on the raw material. Not only were sodium and chlorine important, NaCl was the compound that was commercially made into hydrochloric acid, chlorinated hydrocarbons and bleaching powder. Other important sodium compounds include sodium carbonate, sodium sulphate, baking soda, sodium phosphate and sodium hydroxide. For gastronomical delights, potassium chloride is a salt substitute and potassium iodine is a choice for iodine in the diet. Sodium nitrate and sodium nitrite are used for curing meat.⁶ In addition to the sodium chloride, much of the table salt found in homes today is "Iodized Salt*", which means that it usually contains Potassium Iodine at a concentration of 0.006%. A quarter teaspoon of salt (1.5 grams) provides 67 micrograms of iodine, which is about half of the U.S. Recommended Daily Allowance for iodine. For your thyroid gland to function properly, your diet needs to include iodine. The thyroid gland produces two hormones (thyroxine and triiodothyronine) that your body uses during metabolism. Without these hormones people feel tired, depressed, cold, weak, etc. Iodine is an important element in these two hormones, so without iodine your thyroid gland cannot produce them. When starved for iodine, the thyroid gland also swells, and when it does it is called goiter.⁷

Where does salt come from?

Salt occurs naturally in the Earth and is retrieved mainly from shallow bodies of sea, mineral water, and from mining operations. The way salt is harvested depends on where it is coming from as well as how it will be used. Solution mining, deep shaft mining, and solar evaporation are three ways of getting salt. Solution mining is the way most industrial and table salt is produced. In this process, water is injected into large salt deposits found near the Earth's surface. Companies then pump out the brine, salt water solution, and then send it to be dried at another location. Deep shaft mining is done by digging tunnels to get access to ancient sea beds. This is the primary source of rock salt. The last method is solar evaporation. The sun is used to dry up water revealing the beds of salt. This produces "sea salt", commonly found in cooking and cosmetics.⁸

History of Salt Usage

Native Americans

In the wild, animals roamed the range of salt springs licking the salt they needed. Humans consumed wild game with a sufficient amount of salt in their diet. As their diets improved to mostly cultivated crops, their salt intake increased. The Native Americans followed animals to salt springs and eventually began their own salt supply. The Onondaga Tribe of New York and the Tunic of Louisiana were the first Native Americans observed to boil brine water from Saline. They flavored their food with salt, but no sign of salt being used to preserve meat or fish. Their technique was the drying method over slow fire pits for preserving meats.

Over many years, explorers crisscrossed the vast land, catching on to boiling seawater in small amounts to preserve meat. The colonists settling alongside the seawater used much the same process to make their salt. The military used indentured servants to make salt.⁹ Salt making soon spread across much of the eastern part of the United States, mainly along seawater and began monopolizing the production.¹⁰

Cross Culturally

Salt has been a primary part of many cultures across the world and its history. The popularity of salt in China dates back to 2700 B.C. Ancient Egyptians are known to have access to salt for curing meat and fish. Europeans had access to salt. In Central Africa, it was only available to the wealthy. Salt was an expensive production controlled from ancient times. Chinese and Egyptians were the earliest known to have methods of salt extraction. The earliest Egyptian record demonstrates salt supply used for various religious rituals other than food. China experimented with 40 different types of spices as their artwork. In time, China realized taxing salt was a revenue source. Soon salt became a method of trade and currency as it spread westward. Ancient Greece practiced trading slaves for salt. As history conveys, the salt root word goes back in time as “salary.” The Roman army was given an allowance in salt. The word “salad” also came from salt as Romans salted their leafy greens and vegetables. As the popularity of salt spread, this commodity became heavily taxed, and countries even went to war over it. It was so popular and valuable like gold, that there were even salt prospectors. At one time, the value of salt per ounce was equal to gold and the demands inspired black marketing, riots, and smuggling.¹¹

Present Usage

Flavoring agent

Salt claims a significant role in extracting flavors and emphasizing the flavor. Of course, people have their own definition of taste. Salt does more than just season. In actuality, salt musters other flavors. Salt will increase texture and flavor in the food we are consuming. The taste, smell, and texture place unique characteristics in almost everything we consume. Salt makes food taste better. Your tongue is physically a detector for flavors thought to be an amazing organ that does what it does. The tiny white and pink bumps, naked to your eyes, are called papillae, hair-like receptors develop the taste buds. Taste cells connect to nerve cells, which signals the brain when taste receptors are stimulated to sense the flavor. Chemical compounds that produce bitter, sour, salty, sweet, and umami or savory, taste sensations are caused by binding of molecules to receptors on taste cells. The sensory cells perceive taste and smell by the tongue. This creates the flavor in food. The tongue contains different receptors. They are designed with a sophisticated network. The sense of taste can detect only molecules dissolved in water using saliva. Should flavoring be appetizing, it increases our saliva and gastric juices, making meals truly mouthwatering. Both smell and taste senses or other names, olfactory and gustatory can distinguish different substances because the tongue is capable of sensing bitter, sour, salty, sweet, and umami. In some way, the smell of odors detected by the sense of smell undeniably channel to olfactory receptors to distinguish smells of flavor

causing us to vomit or nausea. Of course, this is the reason why our mouth and nose are associated. In reality, our sense of taste is dull. The tongue is more sensitive overall. It creates taste sensitivity for bitter stuff to protect us from poison. The sour taste comes from acidic food. Salty taste carved by our body for its nourishing for physical functioning is the core component of taste sensations. Sweet taste buds will obviously relish the taste.¹²

Simple reasons for adding salt

The salt's job is to trigger flavor in bland recipes. Seasoning meat with salt is to hydrate it which helps it to hold water and spreads out the reasonable amounts of selected seasoning. Another method of tenderizing meat is hanging it at a controlled humidity for a certain amount of time and temperature, called aging. Some meat age quickly and others age slowly. Once it reaches its correct age, it will muster the flavor. When cooking pasta or potatoes, salt is added to increase the temperature of the water to the boiling point. The water will boil hotter, making the food cook faster. It is best to add salt to boiling water, then add pasta. Otherwise, you might experience an aftertaste.

Adding salt, acts as a natural antioxidant in the dough you make when making different types of bread. This will add taste by triggering the flavor and aroma in the flour. Salt becomes an important ingredient in the mix; it helps tighten the gluten structure and add strength to your dough; i.e., dough is not sticky. Further, it helps to maintain the structure that holds on to the carbon dioxide gas that formed during fermentation to support the volume. Salt also contributes to shelf life. Salt will prevent food from going stale too quickly. You can knead dough without salt, so gluten can develop faster. Dough will be smooth and elastic. This process will also allow for enzymes to do all the work of development.

Types-Sea Salt, Kosher Salt, Popcorn Salt

Salt can bring out all five tastes, salty, sweet, sour, bitter, and savory. Salt enhances flavor and can transform taste by its interaction with other food or drink. As an example, just a sprinkle of salt may make tea and coffee taste less bitter. Some people also put salt on watermelon to make it taste sweeter. Since ancient times, people used salt to preserve all different kinds of food, because there were no refrigerators.

Sea salt is commercially available to the market because it can be sold if it satisfies the FDA rules of its purity. Sea salt processed into table salt does contain an anti-caking extract to keep grains from sticking together. A limit of 2 percent is permitted for salt to contain additives such as calcium silicate. Other tasteless and odorless chemicals that contribute to anti-caking are the compounds - magnesium carbonate, calcium carbonate, calcium phosphates, and sodium aluminum silicates. The finer sea salts have interesting flavors of taste, smell, and texture. Sodium chloride, calcium, and magnesium sulfates do not have an odor because of low vapor pressures. Any type of sea salt ingested nasally in fine form does give a metallic sensation. The taste and texture detects the way they were harvested and processed. Sea salt comes in various shapes: flakes to pyramids, to clusters, to irregular, jagged fragments. The sizes range from fine to coarse. The bigger and flakier crystals of sea salt can bring an explosive flavor when added just right before serving. The admiring taste flavor is desired by chefs because of bursts of saltiness. The complex shape is what delivers the taste. The same cannot be said about table salt. In table salt, the salt dissolves once it lands on the tongue.¹³

Kosher salt is used as a koshering process, and works to remove blood from meat. Kosher salt is mined or collected from the sea. It must be coarse and irregular in form so it can stick to the surface of the meat during koshering. Because of its texture, it is best used by the pinch. Pinching enables for easy pick up with

your fingers, and since the salt grains don't dissolve immediately, you can visually see where you've sprinkled it. Kosher salt has a tiny bit of additives for anti-caking including sodium ferrocyanide. It also contains 1/100th of 1 percent of iodized salt for iodine-deficiency disease goiter. Kosher salt is not very popular among chefs because it dissolves more quickly and evenly into baked goods.

Popcorn salt is very fine powdered particles for the purpose of sticking easily to the kernel. This process is difficult because salt does not stick to dry food. Normally they will easily flake off. Popcorn salt is expensive.¹⁴

Food Preservative

Salt perhaps aided as a preservative for food from the prehistoric times to just before refrigeration was available. Salting food prevents harmful organisms from getting water they need to survive and flourish. Field points out, "If the outside environment is saltier than the inside of an organism, the water diffuses out to dilute the salt. The organism dries out, even if there is lots of salty water outside."¹⁵ Many disease organisms are unable to grow in the presence of salt. Taste is not the only reason for adding salt to food. It was the best methods for preventing the growth and survival of undesirable bacteria. Salt is effective as a preservative because of the "water activity" of foods. The water activity of a food is the amount of water available for microbial growth and chemical reactions. Through simple osmosis, salt, added to either solid or liquid food products draws available water from within the food interior and dehydrates it. This mechanism weakens the microbe's enzyme and DNA activity to keep the cell from growing – the bacteria which can cause food poisoning.¹⁶

Hidden Salts (Processed foods)

Processed foods contain sodium for preservation and taste. If the food is highly treated, it will have a higher salt content. Some processed foods have elements added, like sweetener, oils, colors, and preservatives. It includes food that has been cooked, canned, frozen, packaged and changed in nutritional structure by fortifying, preserving or preparing in different ways.

Per the 2015 Dietary Guidelines for Americans, the recommended upper limit for sodium consumption is 2,300 milligrams of sodium per day for adults. If African-American, age 51 or older or have high blood pressure, diabetes or chronic diseases, the consumption should be 1,500 milligrams per day. An average American consumption of sodium is close to 3,400 milligrams of sodium per day. That is 3.4 grams of salt or nearly 2 teaspoonfuls. Evidence confirms that ingesting too much sodium can increase blood pressure, which is a danger factor for stroke. Therefore, limiting your sodium consumption can benefit your well-being.¹⁷

The study also states that 77% of processed foods already contain excess salt. As I inventory 3 members of my family's pantry, I found some processed foods with high sodium are as follows: 10.5 ounce of Campbell's Vegetable beef soup containing 890 mg of sodium and a 37% of daily sodium recommended, 12 ounce SPAM 790 mg of sodium and 33% of daily sodium, 2.25 ounce Maruchan Instant Lunch Chicken Flavor Ramen Noodle Soup containing 1190 mg and 50% of daily serving of sodium, 6 ounce Gluten Free Rice Pasta & Cheddar Cheese Mix containing 460 mg of sodium and 20% of daily serving of sodium after preparation, 6.8 ounce of Rice Roni Beef Flavor with 730 and 34% of daily serving of sodium after preparation, 5.6 ounce Food Club Skill Classics Hamburger Beef Pasta sodium content of 540 mg and after prepared 26% of daily sodium servings, 32 ounces of Aunt Jemima Buttermilk Complete sodium content of 450 mg and 19% of daily serving of sodium, Nabisco Original topped with sea salt Premium Saltine Crackers 135 mg per 5 crackers, 16 fluid ounce Food Club Ranch dressing 260 mg and 11% daily value.

Clearly, I assume most people in my community would have similar processed foods loaded with sodium in their household. There are several possible explanations for this. Some of these food items have higher salt content because of their bland taste, perhaps due to a lack of freshness. My better explanation, maybe just having an addictive effect of high salt consumption. For example, a person consuming more salt in their diet will want more salt. In some cases, people who are told they have high chronic disease risk will reduce their sodium consumption for two or three months and in time their body will begin to crave salt. This will lead them to consume higher levels of sodium to satisfy their cravings. Lastly, our local grocery stores stock 90% of processed foods.

Health Benefits and Risks Associated with Salt

Salt as a Nutrient Source

As we know, salt, like water and air, is crucial to the well-being of our body. The sodium and chloride ions in salt regulate the nutrients needed for proper bodily functioning. Chloride is needed for proper growth and development of the brain and other neurological functions. Hydrochloric acid is required in preparing our digestive system. Chloride is necessary for proper functioning of our adrenal glands to release and control of over fifty hormones. Sodium ions help the body execute a number of simple tasks. Dr. Mercola states, "This includes maintaining the fluid in blood cells and helping the small intestine absorb nutrients. Sodium is necessary to activate enzymes in glial cells that provide for long-term planning or creativity." Sodium improves our metabolism and regulates the digestion system. In general, additives are required to insure there is proper regulation and maintaining of the blood pressure.¹⁸

Sodium is needed for blood regulation and its absence can cause serious impairment of bodily function. The electrolyte regulates the bodily fluids and transmits electrical impulses in the body. Sodium plays a pivotal role in enzyme operations and muscle contraction. A pinch of salt sprinkled on the tongue may help improve an allergic reaction or an asthma attack. Your body needs salt to maintain the proper stomach pH. Salt lowers adrenaline spikes. Salt improves sleep quality. However, for some of us, eating too much sodium can raise our blood pressure, because sodium attracts water and the extra fluid increases the pressure on your blood vessels. If we are careful and eat only a little sodium, our body will not retain that extra water. Our blood pressure will stay in the normal range. Salt is made out of sodium and chloride. Sodium is the part of salt that affects blood pressure. In biological terms, the kidneys suffer trying to do extra work by keeping up with excess sodium in the blood stream. In addition, increased blood volume also makes the heart work harder and more pressure on the blood vessels, eventually leading to high blood pressure. High blood pressure is the leading cause of cardiovascular disease.¹⁹

People who are at high risk of developing health problems related to salt consumption are people age 50 and over, people who have high or slightly elevated blood pressure, people who have diabetes, and African Americans. As a member of the Navajo tribe, I am concerned about sodium because of the increase of diabetes and high blood pressure among the Navajo people. It is especially important because we are seeing these health conditions even in our young people.

Teaching Strategies

Reading - Vocabulary

In order to gain knowledge of science content, students will constantly build on the science vocabulary they need to access grade level content text. In small groups, students will be instructed to explore “talking science” sessions. Students will talk science as they explore vocabulary words. Students will also be presented with informational texts on topics specific to daily activities. With the rich conversations and information, students will stay deeply connected to the text on the page and develop habits for making evidentiary opinions or informed statements, as well as writing for comprehension of text. Once the reading exercise is completed, students will discuss words in bold print and take notes of their meaning on the side margin. Students will be encouraged to wander and talk about science concepts or principles. English Language Learners will be provided with words’ meaning and use of visual clues to help with literacy development. A contextual information graphic organizer will also be utilized for studying science vocabulary words. This will be assigned for daily homework. Students will engage in predicting the meaning of words and comparing with a partner’s prediction.

Reading

Students will experience a variety of strategies and skills for reading. They will read *“The Magic School Bus Explores the Senses,”* for a tasting experiment. This reading will go along with the activity of comparing frybread tasting “Salt to Taste.” They will also be read aloud “The Long Walk,” for connection to the Presenter theme and the frybread activity. Other readings will be informational texts. Some readings will relate to Diné Culture & History and topics of general information about salt and its chemistry, and will include short articles on health and foods. Students will explore the title, headings, caption and looking at maps and diagrams. Their focus skill will be on the main idea and details. They will be reading individually, in small groups, and with partners for discussion. Note taking strategy will emphasize highlighting key words and jotting notes on the side margin to help with the discussion as they narrow down the central idea of the text and using textual evidence. At end of discussion, students will list 3 things discussed, 2 things they have learned, and 1 thing they found interesting or draft a question. Each week, students will create a poster about important information discussed that stood out in their minds as most describing the concept. Posters will be hung up on the wall so students will keep the concept in mind as the lesson moves on to the next activity. Students will use “Think and Search” to answer questions.

Science Inquiry-based Learning

There are many ways to use the scientific method. Here, students will be introduced to the scientific method poster. When science happens in my class, I want to see students doing science. Science as an inquiry-based learning that provides students the opportunity to discuss their question to assist them in guiding their learning through experiments or hands-on activities. Students exploring on their own as they are provided information need to discover what it is that they want answered so that it will be emphasized. Not all inquiry-based learning is about using the scientific method. Some lesson techniques are about reading materials and discussing in small groups, or doing simple research. The focus is to get students to absorb the information and getting them to stretch their skills and curiosity to process their solution.

Writing from Sources

Writing needs to emphasize use of evidence to inform or make an analysis statement. Students will develop skills through making an analysis to respond to ideas, events, facts, and opinions presented in the text they read.

Inviting Guests

A School Nurse and/or Registered Dietitian will be invited to the classroom to take blood pressures of the students and talk to students how to eat healthy to keep a good blood pressure. The nurse/dietitian will share information with the class about their jobs and how a nurse helps people in the community to stay healthy.

Elderly Visit

A traditional elder will be invited to talk about traditional fitness and foods. Immersing students into Dine Culture and History through traditional storytelling and folktales, are practices the community strongly encourages in understanding life (Íiná). These oral traditions and philosophies will clarify the journey and struggles of the Diné people from their emergence to present day. It provides direction and strength to challenge the future. Grandparents teach about the opportunities found in the Dawn and blessings of good health and leadership. Running into the Early Dawn helps you learn about spirituality. In the morning, it is said to be a good time to build a relationship with the Diyin Diné'í (Deities). Diyin Diné'í will run with you and listen to your prayers and bless you with good thoughts. It is very important to reconnect traditional teachings to their lives. The teaching empowers students' confidence as they develop into healthy young men and ladies.

Fry Bread Ingredients

Bluebird Flour

Fine, white and light flour is the famous bluebird flour. Bluebird flour is known for its exceptional elasticity. It is high in protein and gluten. The processing from a kernel of wheat into a particle of flour is a lengthy and time consuming process. Once the wheat is cut, it is brought into the mill to begin a ripening process called sweat. It will sit in storage for 2-3 months at 10-12 percent moisture before its quality is ready for milling. Once it is cleaned, it is readied for grinding, then water is added for moisture content brought back up to 15 percent. Once this is complete the wheat sets for 16 hours in a large softening container. The cooling process hardens the outer bran coat and softens the inner endosperm. Nutrition Facts show a ¼ cup serving contains no sodium.

Once the wheat is sent to the mill, it is passes through a series of rollers which crush and grind, fabricating that aroma of grain under friction. The wheat is sifted a couple of times to separate out the flour that is fine enough to be used in the final product. After it has been sifted, nutrients are added back into the flour. Then it is bleached to speed up the whitening process. The scraps are kept and reprocessed until as much flour has been extracted as possible.²⁰

Baking Soda and Baking Powder

Baking soda has only one ingredient: sodium bicarbonate. Sodium bicarbonate is a base that reacts if mixed with acid. The reaction forms bubble-like foam carbon dioxide (CO₂). With baking goods, the trapped CO₂ gas

makes dough or batter rise. If baking soda makes contact with acid, the reaction will not be what you want to see happen to your dough or batter.

Baking powder contains sodium bicarbonate and two acids. The acids are called monocalcium phosphate monohydrate, dicalcium phosphate dehydrate, sodium aluminum sulfate, or sodium aluminum phosphate. Monocalcium phosphate will not react with sodium bicarbonate while it's dry. However, if stirred into wet dough or batter, the ingredients will react, bubbles of CO₂ are released and can process your dough or batter that did not rise. This happens because baking powder has a different ingredients that releases bubbles of CO₂ and causes chemical leavening. The second acid is sodium acid pyrophosphate or sodium aluminum sulfate. These two acids do not react unless it's mixed with wet or hot batter. Baking powder loses its potency once it's open. It will not rise the dough.

Some recipes will ask for both baking soda and baking powder. They are both leaveners, but chemically different. Acid in baking powder is required to activate and create CO₂ needed to boost the batter, meanwhile, baking soda acts as a neutralizer to the acid in the recipe. Baking powder is double acting which means it reacts to liquid and heat. Too much baking powder will result in bitter taste.²¹

Diné Frybread Story

Some say Frybread is a symbol of pride for the Diné culture. Others connect it to the tragic accounts of the Native American history. Frybread was born in 1862, 155 years ago, a time in history when the United States government forced Native Americans off their homeland and imprisoned them for a period of time; among them were the Diné people living in Arizona. They were forced to walk 300 miles to Bosque Redondo, New Mexico, known as the "Long Walk," to a concentration camp, a land poorly supporting the traditional way of life. Because of poor soil, the Native American people were starving in large numbers. The U.S. government provided rations - canned goods, white flour, processed sugar and salt, bacon and lard. Not familiar with how to prepare these rations, the Diné people were getting sick and dying. Through the trial and error method, the making of the frybread was born. The frybread recipe includes flour, baking powder, salt, and water. The ingredients are mixed and kneaded into a dough. While the dough leavens, a skillet is heated with oil (lard). When the oil is at the high-burn point, the rolled dough is patted into a round shape like a pancake. This pancake shape dough is then placed into the hot sizzling grease and fried. When it cools it is ready to eat.²²

Exposure to these rations provided by the U.S. government in 1862 has created a dependency on salt, sugar, and lard. Not knowing the nutritional value for over 150 years has led our Diné communities to deal with obesity, diabetes, coronary heart disease associated with high-blood pressure and high cholesterol. Diabetes in Navajo Youth show there has been an increase in health problems in the United States but is 2-3 time greater within Native American communities. One focus was on Diné youth, 12-19 years of age, with 160 participants. The study demonstrates that being overweight, and having high levels of lipids and glucose, made them vulnerable to these health risk factors later in life. Intervention studies state there is an urgent need for effective strategies for obesity treatment aimed toward children. Further, eating and physical activity habits are generally practiced early in life into adulthood. Interventions needs to involve full participation in order to be effective.²³

Classroom Activities

The purpose of this unit is to learn about the harmful effect of high salt intake. It is important to see children consume less salt rather than excessive amounts. This unit will begin with building background information on salt. Activities and worksheets will be used to engage students about the issue of salt or sodium. The experiments with salt can encourage students to take steps in establishing healthy eating habits.

Summarizing

Summarizing requires extracting essential information from the text's main idea and supporting details. It contains the writer's decision on what to include (what is important in the text), what to eliminate (irrelevant text), how to paraphrase and how to reorganize information. In general, it's about restating the main idea of the text in as few words as possible to confirm the summary is accurate to its original meaning. Summarizing helps students understand the text.

Day One & Two - Salt History

The lesson will begin with the introduction of salt history. The activity will focus on building the background of salt. Students will be able to authentically construct a short paragraph that includes the main idea and supporting details of the text. Divide students into groups of 4 or 5. Make copies of text features graphic organizer and main idea graphic for each student. Assign reading "A Brief History of Salt," from TIME. The article's organization is not formatted with section headings and we are still using the graphic organizer for flexibility. The layout involves three parts. First, students start with the right-hand boxes of the graphic organizer in the top box, titled "Important Ideas." The student will write down what they think are important ideas using the text features "title." Students will move below the box "Important Ideas" to the box titled "Important Vocabulary." As they skim the text, students should notice some vocabulary words will be unfamiliar to them and enter those words. Students will use text features graphic organizer. The importance of using this approach is to spot words and know key words to understand the text section. Reviewing students' responses in this section will give you a chance to understand what they are thinking and teach words the class had identified as relevant to the text. In the third step, students will fill in the box "Get the Gist" section with ideas on what they think the important text is about. To do so, students should read several paragraphs. Strategic readers scan text features before reading to get the main idea of what they are reading, and then they strategize a plan for their reading based on what they gather from the scan. If the material is unfamiliar, strategic readers will choose to how to read: may want to slow down, read some sections more carefully than others, or read paragraph by paragraph and then focus on understanding the text. The key to using a graphic organizer is to check in with teacher before they begin reading quickly and by doing so, you can assess their readiness to read text - and intervene if they are not ready with the vocabulary words.²⁴ Students should be thinking, discussing, and collaborating with their groups before moving to the next step. This gives some time to correct the group's misunderstanding and provide input and feedback. Once this graphic organizer is complete, students will use their scan text features notes to write the main idea and three supporting details. Again there will be an opportunity for thinking, discussion, and collaboration on the main idea and three supporting details. Students will be asked to present their results to their group.

Inquiry-Based Learning - Salt and Microscope

Inquiry-based Learning technique will be utilized, much like how scientists organize and use the information

they gather to answer questions. Having students make predictions will help develop questions related to their observation and apply what they already know to form a hypothesis. Using observation skills will require the use of different senses to learn about an object and event. Finally students will state their results based on the analysis of the data gathered.

Chemistry of salt – the hands-on activity will focus on the physical properties of salt and its content. Students will investigate by observing substances under magnification and record detailed observations of shape and texture. This lesson comes from Science NetLinks.²⁵ They have a unique way of teaching this section explaining salt’s shape and texture – (kosher, sea, and table salt).

This activity permits students to use simple experimentation methods of prediction, observation, recording data, and concluding the results. Each group will rotate through 4 stations. One group will be examining with the naked eye; a teaspoon of each of the different types of salt (kosher, sea, table salt) will be placed on a black construction paper. The second group will be observing the substances with a hand lens. The third groups will be observing with a microscope. The last group will be observing with an Electron Microscope. Students will compare and contrast the different scope use in each station.

Students will make their predictions at the beginning of each activity. The students are instructed to record data on the experiment worksheet “Salt: Up Close and Personal.” Students will be encouraged to make detailed observations; notes should be descriptive and draw what is being observed. They will be asked to think about what they have seen and try to infer the meaning. To end the activity is by having a group demonstrate their understanding of why something happens, how it behaves or what properties it contains? The groups coming together allows students to pin point their conclusion a lot quicker, so at the completion of each group rotation to the 4 station, they will meet, discuss and collaborate their findings before moving to the next station. Detailed notes should describe geometric shapes and simple description should be discouraged; such as “I see lots of dots.”

Vocabulary words: kosher, sea, salt, microscope, hand lens, slide, coverslip, properties, geometric shapes and figures, colors, description – adjectives.

Review skills: prediction, inference, drawing conclusion, recording data.

Materials

Kosher, sea, table salt

Black construction paper

Hand lens

Microscope

Slide and coverslip

Salt: Up Close and Personal worksheet

Pencil

At completion of the activity, students will return to their seats and reflect on their recorded data. They will

use the questions on board to reflect. What are the most interesting difference seen with each magnification? How did the data sheet help you with this activity?

For assessment, look at each record data to see detailed notes on salt, in written form and drawing with as much detail. There should be noticeable differences in notes and drawing from simple to complex record.

Day Three & Four - Periodic Table

Dmitri Mendeleev is credited with developing the first periodic table, in which he arranged the elements by atomic mass. He soon found out that he could better predict the properties of missing elements if he arranged the elements by atomic number. His arrangement was further supported when the periodic table was used to predict the existence of noble gases before they were discovered. Many scientist have contributed to the formation of the periodic table.²⁶

As they have learned about the shape and texture of salt on Day 3 & 4, students will familiarize themselves with the periodic table. For this experiment, make copies of the periodic table for each student, hand them out to the students and instruct them to review the table. Ask what properties are used to classify each element? What do you notice of its organization, name and symbols, atomic numbers, and colors? Explain the atomic number and the number of protons in an atom. The atomic symbol is the letters representing the element, and the atomic mass is the average mass of an element in atomic mass units. Have the students identify the different groups as reactive, metal, metalloid, or nonmetal and locate them on the table. Show examples of a few elements such as neon light, iron nails, a balloon filled with helium, a gold ring, nickel, penny, and sulfur from a rock kit. Divide the class into groups of five, assign each group by element and the student's assignment is to research their element using the internet (Chromebooks). What are the characteristics of the element? How is it discovered? Draw the element? What is the element used for? What other interesting facts did you learn about the element? Students will create a poster of the element they are researching and present it to the class. An assignment extension is for students to take a poster home and find two or three examples of the elements at home or in their community. Have them take a photo of their example and present it to the class. This activity could take two days.²⁷

Develop vocabulary by discussing the meaning of each word that goes along with the periodic table.

Vocabulary words: atom, molecule, nucleus, proton, neutron, electron, columns, rows, metal, nonmetal, metalloids.

Materials

Periodic Table

Chromebooks

Internet

Color pencils

Poster paper

Neon light, iron nails, a balloon filled with helium, a gold ring, nickel, penny, and sulfur from rock kit.

Day 5 - Salt To Dissolve or Not Dissolve

In this activity, students will investigate and identify some solids that dissolve in water. Students will observe if salt is soluble in water and what happens when things dissolve? In this experiment, students will be using prediction, observation, and conclusion for their results. Divide the students into groups of five and explain they will be mixing some solids with water. Start the lesson activity by developing vocabulary word(s), by writing the word on the board and using the word web format. The Word Web worksheet layout requires the student to predict what dissolve means? Allow for a short discussion by sharing one student's prediction. Next, define the word and write the definition, parts of speech, syllable, affixes, synonym and antonym. The last entry will be by using the word in a complete sentence. Now they are ready to begin their experiment. Ask students if they know of anything that dissolves in water. While they are sharing their experience, hand out To Dissolve or Not Dissolve worksheet to record their prediction and observation. Students will begin with making the prediction first before mixing. With each group, there will be four clear glasses of water, a tablespoon of sugar, sand, glitter, and salt that they will test. They will begin mixing each solid by putting a teaspoonful and stirring it well. They will observe what happens and record their observation on the worksheet. They will repeat their testing with all solids. As students conduct their experiment, the teacher will monitor or have a conversation with the group about their discoveries. Listen to the groups' conversations and check their results of the investigation. At the bottom of the handout, students will write what happened to the salt and sugar mixture. This will lead the group into what was going on with their mixture of salt and sugar. Next, students will watch a video "What happens when stuff dissolves?"²⁸ At the end of the video, students will describe what happened using atoms and molecules.

Vocabulary words: atom, molecule, ionic, covalent bond, sodium, chloride, dissolve.

Materials

Sugar, salt, glitter, sand

Four clear cups

4 cups Water

4 Tablespoons

Dissolve or Not Dissolve worksheet

Pencil

Video "What happens when stuff dissolves?"

Day 6 & 7

Sodium in Snack Foods lesson

This activity came to mind when I observed last year's student body requested snacks to share at class parties and noticed it was packed with high sodium. This was alarming! Of course, this is not the student's fault. I also noticed at the local convenient stores that the stores stock food items with high sodium or sugar. In

2015, our Diné Nation government imposed taxing on junk food but this law did not make people think twice about purchasing snacks with high sodium or sugar. This contributes to the many Native American children facing high risk factors of chronic diseases.

In this activity, students will distinguish two types of snacking by learning how to read food labels to determine whether the snack is a healthy choice or not and the nutritional importance. It is important to look at the amount of sodium for each food snack and learn about the recommended amounts of sodium they should consume on a daily basis. The approach to this activity is sharing important facts about sodium and its consequences. The activity will use hands-on.

First students will learn “salt” and “sodium” do not mean the same thing. Salt is a crystal-like compound found to be plentiful in nature. As stated before, salt has a chemical name sodium chloride (NaCl). It is used to flavor and preserves food. Whereas, sodium is a mineral and one of the chemical elements found in salt. Surprisingly, most people consume too much salt, and salt contains sodium. Too much sodium can raise blood pressure which is a scary health consequences if not treated.²⁹ According to the Dietary Guidelines for American 2015, the daily recommended sodium intake is below 2,300 mg per day. The average daily intake of sodium for two years and older is about 3,400 mg. Students need to understand their body only needs 1,500 mg per day from food and drinks. Students should understand the reason behind why FDA requires nutrition information about food printed on packages.³⁰ Especially the content has a nutrient claim. The nutritional information of sodium on menu items in restaurants or retail food establishment is necessary. It is also important to inform students that some packaged foods and drinks hide sodium level, especially if the sodium is high. This is true if the food does not taste salty. For this reason, it is important to pay attention to the Nutrition Facts Label. The Nutrition Facts Label makes it known, content of sodium in Percent Daily Value (%DV) in one serving of food. This %DV is based on 100% of the DV for sodium, which is less than 2,400 mg per day. In reality, some packaged foods contain more than one serving. So, the person is consuming double the sodium per serving.³¹

As they proceed with the activity, students will be required to bring their favorite prepackage snack from home. Hand out copies of an example of a snack’s Nutrition Fact Label. Read the Nutrition Facts Label to demonstrate how much sodium is in the snack. Share important health effects of consuming too much sodium. Share research Figure 1, “Diabetes in Navajo Youth.”³² The research emphasizes that too much salt raises blood pressure; not only does it raise blood pressure, but it causes diabetes and other chronic diseases.

Begin the activity by engaging the students with the questions. What is sodium? What is the recommended daily limit for sodium? How much sodium does your body need to function each day? Next, have students look at their snack’s Nutrition Facts Label. Have students write the sodium on their science journal and compare it to the daily serving recommendation of sodium for each day and explain the amount of sodium their body needs to function each day. Tell them to study the numbers and ask what they think about the numbers. Students will discuss in small groups their thoughts and what they can do to reduce the daily sodium consumption. Each student will measure the salt content in mg of their snack and put it in a zip lock snack bag. They will then tape the bag of salt contents to their snack, and tape it to the chart on the board. Finally, students will look at 25 samples and rank the sodium content for each snack.

Day 8, 9, & 10 Cultural Food Experience

An essential part of the Diné Culture is storytelling. This teaching will embrace identity, history, and traditional methods and practices for addressing health lifestyles. Providing presentations about the

traditional foods, the preparation of food, and how they are consumed portray people's way of life and the environment they live in. Inviting a community elder to share their stories about food allows children to demonstrate the need to reclaim traditional diets. Elders are an excellent resource; their stories are about traditional food that is home grown and harvested locally. Lessons like these are important because they cover traditional ways of life; this is a disturbance for most folks because they now consume more processed and store bought foods rather than the organic traditional diet that protected them from certain illnesses which are now widespread among many Diné people today. For this reason, their health has suffered. This activity involves Speaking and Listening. Students will listen with some degree of empathy. Once the presenter shows up, students will sit in a circle on the floor. The presenter will sit on the chair. She will share her expectation of behavior and respect. Once expectation is established, she will introduce herself. The speaker will code switch as she presents - meaning there are some teachings said in Diné language which provides the concept in a meaningful way. At the end of the presentation, there will be some time for questions and discussion. Students will return to their seats and follow a 3-2-1 strategy. Write three things they learn, two things that were interesting, and 1 question.

Frybread "Salt to Taste"

The part of this unit is where the students begin their thinking on the chemistry of cooking. We open the unit up with sharing the Frybread recipe and introducing all the ingredients: Bluebird flour, salt, baking powder, and warm water. The experimental techniques are observing, recording, and drawing a conclusion. Students will learn about the sense of taste and explain using descriptive words. When students are using their taste sense, their tongue is experiencing sweet, salty, sour, bitter, and savory on all parts of their tongue. When they smell, students are using their mouth and nose. Now we will divide the class into two groups of 14 students. One group will make the dough by mixing all the ingredients and the other group will make the dough without adding salt. One student will volunteer to mix and knead the ingredients into a soft dough. In the meantime, other members of the group should be observing - taking notes and sketching. Once the dough is mixed, it will be set aside for the dough to set. In the meantime, students will be asked what food they had for breakfast and the different tastes.

Vocabulary words

Taste, smell, sweet, bitter, sour, and savory

Materials

Bluebird Flour, baking powder, salt, 2 glasses of warm water, 2 mixing bowls, measuring cups, teaspoon, 2 pans, 2 hot plates, large vegetable, paper plates, 2 aprons, four small paper cups, cube lemons, salt, sugar, 2 dark chocolate candy.

Appendix

Inquiry Process

Inquiry Process establishes the basis for students' learning in science. Students use scientific processes: questioning, planning and conducting investigations, using appropriate tools and techniques to gather data,

thinking critically and logically about relationships between evidence and explanations, and communicating results.

Observations, Questions, and Hypotheses

Formulate a relevant question through observations that can be tested by an investigation.

- A. Formulate a relevant question through observations that can be tested by an investigation.
- B. Formulate predictions in the realm of science based on observed cause and effect relationships.
- C. Locate information related to an investigation.

Scientific Testing (Investigating and Modeling)

Design and conduct controlled investigations

- A. Demonstrate safe behavior and appropriate procedures in all science inquiry.
- B. Conduct simple investigations based on student-developed questions in life, physical, and Earth and space science.
- C. Measure using appropriate tool and units of measure.
- D. Record data in an organized and appropriate format.

Analysis and Conclusions

Analyze and interpret data to explain correlations and results; formulate new questions.

- A. Analyze data obtained in a scientific investigation to identify trends and form conclusions.

Communication

Communicate results of investigations.

- A. Communicate verbally or in writing the results of an inquiry.
- B. Choose an appropriate graphic representation for collected data.
- C. Communicate with other groups or individuals to compare the results of a common investigation.

History and Nature of Science

Scientific investigation grows from the contributions of many people. History and Nature of Science emphasizes the importance of the inclusion of historical perspectives and the advances that each new development brings to technology and human knowledge. This strand focuses on the human aspects of science and the role that scientists play in the development of various cultures.

History of Science as Human Endeavor

Identify individual, cultural, and technological contributions to scientific knowledge.

- A. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.

Science in Personal and Social Perspectives

Science in Personal and Social Perspectives emphasizes developing the ability to design a solution to a problem, to understand the relationship between science and technology, and the ways people are involved in both. Students understand the impact of science and technology on human activity and the environment. This strand affords students the opportunity to understand their place in the

Changes in Environments

- A. Explain the impacts of natural hazards on habitats.
- B. Propose a solution, resource, or product that addresses a specific human, animal, habitat need.

Science and Technology in Society

Develop viable solutions to a need or problem.

- A. Describe the relationship between science and technology.

Teacher Resources

A brief history of salt

Bruchac, Joseph. Navajo Long Walk. 2002.

Cole, Joanna. Degen, Bruce. The Magic School Bus - Explores the Senses. 2001.

5th Grade AZ Science Standards

Kurlansky, Mark. SALT: A World History. New York. 2002.

Lesson 5: Shaking Your Salt Habit pages 15-19

http://www.dcf.ks.gov/services/ees/Documents/Food_Distribution_Programs/CSFP%20Manual%20Exhibits/Exh%20H%20CSFP%20Nutrient%20Lessons.pdf

Video: When happens when stuff dissolves?

Salt up close and personal

Scanning Text feature example

Science: A Closer Look. Macmillan/McGraw-Hill Education. The McGraw-Hill Companies, Inc. New York. 2002.

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4. Salt's Effect on your Body
5. Shaking Out the Facts about Salt
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7. Why do they add Iodine to Table Salt?
8. How Food Preservation Works
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27. Elements of Chemistry: The Periodic Table
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32. Prevalence of hypertension among Navajo Indians: findings from the Navajo Health and Nutrition Survey

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