



The Chemistry of Indigenous Cooking

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Introduction

I currently teach high school Special Education students, with mild to severe and Autistic disabilities, in a small classroom setting. All my students use a variety of learning styles. These include kinesthetic, visual and auditory learning. Every new lesson must be taught repeatedly but also in a varied way, such as color coding, creating visual posters or doing a make and take activity. I teach functional reading, writing, math, science and soon will teach social studies. Despite my students being in high school, their academic levels are anywhere from Kindergarten to Third grade. Two of my students are non-verbal, one student is minimally verbal with limited mobility, and the rest are able to communicate. Good attendance is a strength for my class; each student attends 95% of the time during a school year. A few of the things I work on continuously on are: Writing and Grammar. They progress academically in reading and math throughout the school year. However, writing two sentences or an introductory paragraph has been a challenge with my students. They have access to a laptop and iPad in the classroom. We have text to speech, but they easily get frustrated trying to correct the errors verbally or their speech is not clear enough. Half of the students attend Speech services weekly. Two of my students are unable to grasp a writing tool. Despite their communication concerns, they appear to understand our directions by how they react when it is time to work. They stay engaged about 60% of the time and mini breaks help.

The high school I teach at is located on the Navajo reservation. In the United States, there is 326 federal recognized Indian reservations. The Navajo Nation is the largest reservation that covers 27,000 square miles in the Southwest region. There are close to 400,000 enrolled members; enrollment includes a CIB, Certificate of Indian Blood. We are near the middle of the reservation, so we do not have access to the cities surrounding our area. There is only one grocery store, we normally drive 2-3 hours away to enjoy a Walmart shopping spree or other grocery stores. There are roughly around 7,000 community members living in my community. We still have families living in hogans without electricity, running water or plumbing. Our school buses travel close to 55 miles one way to pick students up. Despite being in such a rural area, our school building is quite big and attractive. Sports are widely participated and publicized, so a majority of the high schools on this reservation have an enormous gymnasium. We host close to 650 students from grades ninth to twelfth. Close to 85 students are identified with disabilities. Our high school recently received the letter A grade. I teach ninth to twelfth graders for six out of seven periods daily. I usually have around 9-12 students in my classroom and one student being taught home bound. I teach all core subjects in addition to Career

Exploration and Life Skills. One of the Life Skills lessons is cooking. I am excited to add in science standards. My students will gain a deeper understanding of science as well. This will make science fun and exciting while enjoying a good dish.

Our district celebrates one full week of Native American Heritage. Each school day involves one activity that students may participate in; an example is making Clan T-shirts. The Navajo clan system is a matrilineal structure that guides our social interactions and relationships, especially with dating and marriage. There are 140 clans in the Navajo system. The primary and most important clan is your mothers'; it is our identifier, our bloodline. An individual has four clans: mother, father, maternal grandfather and paternal grandfather.

Purpose/Rational

After our school's data digs with the Science Assessment, I know that I will need to add a detailed unit on chemistry. The Arizona State Academic Science Standards incorporate discussions and critical thinking strategies. I learned from attending YNI 2026 that chemistry components are imbedded into everyday cooking. Understanding the substance(s) and the changes will teach my students some health benefits. They could use this in Life Skills and transition from school to post-secondary. Cooking is an everyday lifestyle and learning the benefits of health along the way is rewarding. Most students live with or near their grandparents, who suffer from diabetes, high blood pressure or heart disease. This unit will also include information on carbohydrates and historic facts about the Navajo people. There is still a population of people that live off the land, using agriculture. People continue to grow crops and raise livestock: horses, cattle and sheep. It's common for families to live in remote areas and have over an acre to plant corn, squash, beans, melons and peppers. The objective for this lesson is for students in the Life Skills classroom to be able to identify home cooked meals as healthy or not healthy. Charts will be made for carbohydrates, fats and protein. During the teaching part of this unit, students will put the gram amount of the Blue Corn mush, Grits, and Cream of Wheat on a Nutrient Chart.

My group of Special Needs students need constant scaffolding and hands-on activities in the classroom. The Chemistry of Indigenous Cooking will be a 9-12th grade science project. It will be taught integrating Arizona Standards and the Dine' Philosophy of Education Standards. This unit will be 2 weeks long for 40 minutes, 4 times a week. There will be 3 activities. Students will visit the campus Cultural Center to hear stories about Navajo cooking, tools used to cook and will participate in two of their presentations.

I am excited about learning how Indigenous foods can be categorized into a Physical change or a Chemical change just by the method of how a dish is prepared and cooked. I hope to gain a better understanding of the macronutrients. Our body needs a certain amount everyday as fuel. Carbohydrates gives our body energy; runners fuel up on pasta before a race. Fats store energy and can protect our organs. At the YNI 2026 seminar, we learned that plant oils are higher in beneficial nutrients rather than animal oils. Proteins helps build and repair muscles and cells; most body lifters will eat high protein meals or add protein powder to their drinks.

Content and Background Knowledge

What is a Physical change?

Physical change is when matter is altered by appearance or form, but the chemical components remain unaltered. The molecules remain the same before and after because the chemical bond does not break nor is a new substance created. Appearance such as shape, color, density, and volume may change without a chemical reaction. One example is with a clove of garlic. The garlic clove can be chopped, sliced, smashed and minced; the matter is still the same despite the change in shape. Another example is paper. Paper can be cut and crumbled, which only changes the form. This is a good example of reversible change, because the sheet of crumpled paper becomes a sheet of paper again. Reversible change does not always happen. For example, when garlic is minced, it cannot be shaped back into a clove or when a log is cut, it cannot be put back together. The most popular physical change to teach beginners is about water. Freezing water into cube trays to make ice cubes transforms liquid into solid which may turn back into liquid through the process of melting. Adolescents enjoy playing with clay. They take a piece of clay and squeeze it from hand to hand. By doing this, the clay softens, which becomes easier to mold into a shape, but only the shape and texture change. When the clay is stored back into its container, the texture and shape changes back to its original form. A phase change occurs with altered temperature or pressure. From the website, Physical Changes in Chemistry. – ThoughtCo. August 5, 2024. (viewed 7-13-2026), one learns that a mixture that involves “mixing together materials where one is not soluble in the other is physical change. Note the properties of a mixture may be different from its components.”[1] An example of a mixture is blending sugar and water. The sugar will dissolve. When boiled, the molecules will separate, and the sugar will form at the bottom. Another example of physical change is mixing bread ingredients. For Fried Bread, you mix in flour, salt, baking powder and water until it becomes a soft dough. The substances used in the dough do not change their chemical composition.

While attending the YNI 2026 seminar, we discussed how a physical change in cooking is identified. Melting butter, turns the butter into a liquid. Chopping tomatoes for dirty spaghetti, changed the size. For both of these changes, the substances stay the same. We made salad dressing by mixing vinegar with oils, which are not soluble. We were able to observe the separation of substances when we let the jar sit. The heavier substance will usually stay at the bottom of the container.

What is a Chemical change?

A chemical change occurs when one substance is changed into a new substance due to an energy change through light, sound or heat (combustion). The atoms break the old bonds and make new bonds. Another chemical change that may occur is the change in color (wood is brown but after burned will turn black or grey). Gas and odor may be formed during a chemical change (when baking a cake for example, the aroma is present when it is almost done). Chemical changes are irreversible, meaning, they cannot be undone. A new substance takes the place of the original substance. Atoms break apart, creating a new bonds. Some signs of a chemical change are the change in color, it may produce an odor (aroma), it may absorb or release heat, it may release gas and it may produce light and/or sound. Wild plants that grow outside will convert carbon dioxide and water into glucose and oxygen by using sunlight through light energy, from the website, Chemical Change Definition in Chemistry, - ThoughtCo. August 2, 2024 (viewed August 8, 2026).

KEY TAKEAWAYS: CHEMICAL CHANGE[2]

- A chemical change occurs when one substance is transformed into one or more new products via a chemical reaction.
- In a chemical change, the number and type of atoms remain constant, but their arrangement is altered.
- Most chemical changes are not reversible, except via another chemical reaction.

At the YNI 2026 seminar, we witnessed chemical changes in cooking. Popping popcorn is considered a physical change; however, for it to be classified as a chemical change, the popcorn will need to be burnt. In the seminar, pizza dough was made and fried over hot oil. The Maillard reaction gave the dough a delicious smell when it was done.

What is the Maillard Reaction

From the website, Maillard Reaction – ScienceDirect. 2016: “The Maillard reaction is a cascade of reactions initiated by the condensation reaction of an amino group with the carbonyl group of reducing sugar. In dairy systems, these are primarily the amino groups of lysine and arginine as well as N-terminal amino groups of proteins and peptides while the reducing sugar is lactose (or glucose and galactose in lactose hydrolysed products).” The Maillard reaction is responsible for browning like burnt, charred, toasted are some examples. From the website, Serious Eats. May 13, 2023: “The Maillard reaction is many small, simultaneous chemical reactions that occurs when proteins and sugars in and on your food are transformed by heat, producing new flavors, aromas, and colors.”[3] We have smell and taste receptors that humans rely on when going out to eat. The aroma of bread baking or meat grilling or coffee brewing entices us to choose what we chose to consume. Beer also goes through the Maillard reaction; the grains are roasted before it is brewed. The heat is the first process in the Maillard reaction, at least above 300 degrees Fahrenheit to cook meat. When baking/frying bread, the dough is white and after cooked, the bread turns a golden to brown color. Meat is raw and red in color, when grilled the meat becomes a dark brown to black color and the aroma is present. People love to eat potatoes. Sure, you can eat it raw, but it will take longer to digest due to the high starch. Roasting potatoes releases nutrients and breaks down the starch so our bodies are able to absorb it. The browning on the outer potato is due to the Maillard reaction. Boiled and steamed potatoes do not go through the Maillard reaction.

What is Lye?

Originating from Old English “ley”, meaning ash water solution, lye is an alkaline chemical, which breaks down two types of molecular bonds. The ester bond holds the fats together and the amide bonds hold the protein together. To make lye, certain types of wood are burned for its ash, such as oak, maple, hickory and birch. Since the early 1800’s, people have modified ways to make lye. Early Native Americans would burn oak or hickory wood into ash. Using a hand-woven basket as a filter, they would then slowly pour rainwater over the ashes. In modern times, water is boiled while using plastic buckets. At the end of the process, you will have an amber to yellowish liquid, this is lye.

NaOH, sodium hydroxide, is what is used to make hard bar soaps from fat. You must follow safety precautions when making soap. From the website What is Lye? All you need to know! - Bee Clean Soaps. May 25, 2022 (viewed 7-25-26), one learns that “Like other corrosive acids and alkali’s, sodium hydroxide in solution form can dissolve proteins quickly and lead to moderate to severe chemical burning when exposed to skin.”[4]

Today, lye is used in shampoo, laundry detergent and some household cleaning products because it is an alkaline chemical. Through saponification, lye transforms fats and oils into soap through chemical reaction. Soap will need to sit or cure for it to become hard and at this time, the lye is neutralized so the soap bar is now safe.

The history of corn and what makes it color

The first corn or maize to be introduced in America came from Mexico around 10,000 years ago. The Indigenous people that migrated North brought the corn seed with them. The Natives found ways to store corn during the winter months by drying the kernels. During the winter months, they used the dried corn to make hominy soup and ground them into a powder form. With this, they made bread, syrup or puddings. Husks of the corn were made into baskets, sleeping mats or masks. In modern times, corn husks are used to roll mountain tobacco to smoke during traditional ceremonies.

The Three Sisters

Predominately planted by Native Americans, three different seeds are planted together. Corn, beans, and squash are compatible, helping each other survive and flourish. As the corn grows, the bean grows around the corn stalk leaving more space for the squash at the bottom. The bean enriches the soil that feeds the corn and squash. The squash grows around the ground, protecting the soil from the sun and keeps weeds from growing. The leaves and stems of the squash are prickly, keeping certain animals from chewing at the crop.

From the website The Three Sisters of Indigenous American Agriculture – USDA National Agricultural Library one learns “The milpa system is the classic example of an efficient multi/mixed cropping system, which tends to be more productive and efficient in use of light, nutrients and water than monocrop systems, given its internal dynamics of complementarity, competition, and facilitation.”[5]

The macronutrient of corn is starch (carbohydrate), which is close to 75% of the dry weight and has natural sugars. Corn is very low in total fat. Corn has some plant-based protein. Essential vitamins and minerals include vitamin C, B vitamin, potassium, magnesium and phosphorus. Health benefits include support of the immune system, aid in cellular energy, maintaining blood pressure and being good for bone and nerve health. The macronutrient of bean has 40-45 grams of carbohydrates, less than 1 gram of fat and 15 grams of protein. Essential vitamins and minerals include folate, iron, potassium and magnesium. Health benefits of beans are support of blood pressure, muscle functions, digestion and heart health. The macronutrient of a cup of raw summer squash is 4 grams of carbohydrate, 0 gram of fats and 1 gram of protein. Essential vitamins and minerals are vitamin C and potassium. Health benefits for eating squash are to boost the immune system and support eye health, and it is low in calories.

Other U.S. traditional foods that are made from corn are corn bread and tortillas. You might wonder, why does corn grow in different colors? Most common colors for corn are white, yellow, blue, red, purple and black. The color comes from a pigment. One kind of pigment is called anthocyanin, this creates blue, red and purple kernels. Another kind of pigment is called carotenoid, which creates white, and yellow to orange colors. Mayan culture thrived off maize. It was a large part of their economic and religious characteristics. They traded maize with other tribes for resources or foods, such as fish.

Health benefits of blue corn

Blue corn is very rich in anthocyanins and is known for its antioxidant benefits. If you suffer from arthritis, diabetes or have low minerals, then blue corn is something to investigate. It should be used in moderation only. Blue corn is on the lower part of the glycemic index, so this helps regulate blood sugar. Its content is anti-inflammatory, so people with arthritis should take advantage of this. Lastly, blue corn is high in fiber and helps lower cholesterol levels and blood pressure, which is all good for heart health.

The History of Juniper Ash

According to the Tree Vitalize article, there are 25 types of Junipers in the U.S., and 67 types worldwide. Junipers survive in harsh surroundings, like around mountains, oceans, deserts and rock bluffs. They developed over 200 million years ago. In the article, Assessment of Juniper Ash Elemental Composition for Potential Use in a Traditional Indigenous Dietary Pattern one learns that “Juniper ash from the southwestern U.S. available for retail purchase was used for comparison. All samples were tested for content of 10 nutritive elements (Ca, copper, iron, potassium, magnesium, manganese, sodium, phosphorus, selenium, and zinc) and 20 potentially toxic elements (silver, aluminum, arsenic, barium, beryllium, cadmium, cobalt, chromium, mercury, lithium, molybdenum, nickel, lead, antimony, tin, strontium, thallium, uranium, and vanadium) as well as n = 576 pesticide residues.”[6]

The benefits of Juniper Ash

The Juniper tree branch will go through a chemical change, when it is burned by fire. Ash is used by a few members of the Indigenous tribes, Navajos being one of the tribes. Juniper ash has a natural source of calcium. In one teaspoon, there is 445 mg of calcium. This benefits people that are lactose-intolerant, mixing a small portion in water to drink. It's equivalent to a glass of milk.[7] Calcium helps with bone health. Another benefit of health is supporting the digestive system. Hospitals in Arizona and Utah serve blue corn mush with the juniper ash to their heart patients.

Teaching Strategies

Chemistry in cooking can serve many objectives and uses cross curricular standards. Students will be exposed to learning the chemistry behind the cooking ingredients and will be able to identify whether it is a physical change or chemical change. Students will learn basic facts about carbohydrates, fats and proteins using a pictorial chart. Cooking is a life skill and for students to live a healthy lifestyle, this unit will allow students to understand basic ingredient information. Students with an IEP, Individualized Educational Plan, will have accommodations and modifications added into their lessons. A life skills class is normally perceived as a class that needs one-to-one aides and performs only with hand over hand assistance. However, despite their disability, all students can learn. Cooking is a hands-on learning, which allows students to move, see and do all at the same time. Visual cue cards will be used for non-verbal students to follow.

Field trips are short and exciting for students. The students' background knowledge of their surrounding area will enhance engagement. The vegetation around their area mostly consists of cedar, pine and juniper trees. Trees are used as firewood, for ceremonial practices and for cooking. A visual chart characterizing each tree will be made so students can see which tree is used in cooking blue corn mush. Another field trip will be to a Native Cultural Center. Here, the students will get a tour of tools used by early Native Americans for hunting and cooking. The Cultural Center we are visiting does have a metate, which is used in Navajo ceremonies and for cooking preparations. One Navajo ceremony where metate is primarily used is the Welcome to Womanhood. The female is required to grind corn for several hours, while fully traditionally dressed. This builds strength and respect for all that she will feed. A member of the Cultural Center will speak to the class about tools used for cooking.

One Dine standard we will work on is showing appreciation in our Navajo language and our customary practices. One short story about corn is written in the Navajo language and will be read out loud to the class. Navajo vocabulary words will be charted for students to see and say, such as the word Juniper. The Navajo word is Gad.[8] Our school is one of the few schools that incorporates Dine Standards, classes still taught at our high school are: Navajo Language I and II and Native Arts and Crafts. One time a week during the school year, the Multi-cultural club holds a pageant. Each school building has several contestants perform to become the next crowned Mr. or Miss Elementary, Middle School and High School. The schools participate in a Native Spirit Week also.

Activities

Day One and Two - Introduction

Begin the lesson with reading Migrant Worker A Boy from the Rio Grande Valley by Diane Hoyt-Goldsmith. This story is about a young boy that spends his summer months picking crops to help the family financially. He works ten or more hours a day in the fields and does not have time to enjoy a normal childhood. The Navajo students will be able to relate to this story because many families on the reservation comes from an agricultural background. Families grow vegetables and raise livestock. Having a farm also takes place in the summer months. After the story is read, there will be a Compare & Contrast, using a Vienn Diagram, to compare Ricky's life (from the story) to a traditional lifestyle of a Navajo. Open discussions and visuals will need to be provided on a poster board. Introduction of new vocabulary words will be included. Vocabulary words can be identified from reading the story out loud and asking short comprehension questions. Only introduce five words. The students will each get a small poster board; they will have access to magazines to cut out agricultural pictures that represent their background.

Vocabulary words: Mexico, migrant, trade, culture, and crop.

Materials

Book by Diane Hoyt-Goldsmith

Vienn Diagram

Poster Board

Used magazines

Pencil, glue, scissors

Day Three

The lesson will begin with teacher reading Zinnia: How the Corn Was Saved by Patricia Hruby Powell. This story is about a crop failing to produce. A Navajo boy is sent to seek help from Spider Woman which ends up taking him on a journey. The boys' quest is a message for the readers about fulfilling one's responsibility even though it may seem impossible. High school students in general face several challenges, whether their home life, academic, social status or in athletics. They will be able to relate to ways they can overcome challenges

and that it's okay to seek help.

Five vocabulary words will be reviewed visually. Students will complete a Story Map, identifying characters, plot, climax and resolution. The sequence of events will be charted on a poster board so students will see the visual quest of the boy in the story in pictorial color to aide in their comprehension.

Students will also complete a worksheet that will help them identify who they can seek help from in their high school: Principal, counselor, social worker, security, coach, and teacher. On a map of the school building, they will highlight where these employee's office or room is located.

Vocabulary words: stalks, perish, canyon, squash, and web.

Materials

Book by Patricia Hruby Powell

Story map worksheet

Map of the school building

Highlighter

Pencil

Teacher made worksheet on School Help

Poster board

Day Four

Students will view two Youtube videos on how Cream of Wheat and Grits are made in the kitchen with no specific person, just a general view of how each are made. Blue corn mush is very similar in texture and how it is prepared. Class will use a three-set Venn Diagram to identify the similarities and differences. Put 3 sticky chart papers up. Title one chart Blue Corn mush, the other Grits and lastly Cream of Wheat. Dig into their background knowledge for each product and write down their responses. Guide the students to talk about what each is made from, how are they prepared and their texture when consumed. Students will need visual aids to be presented; the group discussions will also bring a variety of ideas.

How are Grits like Blue Corn mush you may wonder? Grits are also made from corn. The kernels are also dried then ground. White to yellow corn are higher in starch, containing 36 grams of carbohydrates, 3 grams of protein and 1 gram of total fat per 1 cup serving. From the website EatingWell. Are Grits Healthy? Here's What a Dietitian Says, accessed May 20, 2026, one learns: "Stone-ground grits are good for you, as they provide all the nutrients of a whole grain – including fiber, complex carbohydrates and several necessary vitamins and minerals." [9] Grits also maintain a robust corn flavor. Health benefits for grits are that 1 cup has a supply of iron, with 18 milligrams and is low in sodium. All you need to do is boil hot water, slowly add in the grits and use a whisk to mix until mushy.

Cream of Wheat is a local favorite and the school cafeteria serves this once every two weeks. Cream of Wheat is not made from maize; it is in fact wheat. Adding Cream of Wheat to the tri-Venn Diagram is due to its

texture and how it is prepared. Students will discuss the texture from their background knowledge and describe what it feels like, smells like and tastes like. They will also share out what additional toppings they have used. From the website *Is Cream of Wheat Healthy?* – healthline, accessed March 4, 2020, one learns: “With its smooth, thick, texture and creamy taste, Cream of Wheat is often combined with milk or water and topped with a variety of sweet or savory ingredients.”[10]

Materials

Laptop

Visio board

3 Sticky chart paper

3 colored markers

Day Five

Visit the school’s Navajo Cultural Center. The center displays items from the old traditional way of Navajo life. Such as clothing, tools, cradles, miniature replicas of shelter and animals. The class will listen to the coordinator as she talks about meal preparations using corn. One way corn is prepared as a cake is during a Puberty Ceremony. When a young female has her first menstrual cycle, a female in the family will tie her hair with a strap of deer hide and begin with all the instructions, molding of the girl to womanhood and how food will be prepared. The corn will be ground and mixed with stirring sticks. Then the batter will be wrapped by the corn husks in an open fire pit, which is covered when filled to bake.

Another way the corn is used during cooking is making Kneel Down Bread. The fresh corn, not dried kernels, is ground into a moist batter. Corn husks are used to wrap the batter into the shape of a tamale. After 10-20 have been made, they are placed in an open fire pit to be baked underground for an hour or more. When ready to eat, it resembles corn bread and is eaten alone or with hot mutton stew.

Lastly, the coordinator will explain how corn is used in coffee as a dairy free creamer. The corn must be roasted or steamed prior to grinding the dried kernels. The flavor is rich and when added to hot coffee, it thickens the liquid. Some have said the taste is nutty and earthy with a slight sweetness. Very few elders still use this type of ground corn and it is scarcely made now.

The Cultural Center has six grinding stones on display. The coordinator will explain which stones are used for what food or herb. There are small round stones to grind plants and flowers. The longer rectangular stones are used to grind corn.

Students will implement listening comprehension and oral discussions. They are required to ask 3 questions each at the end of the coordinator’s lecture.

Day six

Activity 1 - Making Juniper Ash

This activity will take place on the 6th day of the lesson. The first activity begins with a fresh bowl of burned juniper ash. Students will not be allowed to burn a tree branch on school grounds; one will be burned by

another adult off campus. The ash will be scooped into a bowl and brought to the classroom for students to notice the chunks and dark color of the burned wood. Students will examine the content and write down what they observe in an activity journal. They will also sketch an image of the ash. Each student will be given gloves and an apron. Students will take turns sifting small amounts of ash into another bowl for 5 minutes, then recording the remnants from the sifter into their journal. The process will be repeated three times to create a very fine powder. The final product will be stored in a glass jar for later use.

Juniper tree with a sifter and ash - Figure 1.[11]



Day seven

Activity 2 - Grinding Corn

On the sixth day of the lesson, Naadaa by McCora Begay and Jefferson will be shown to the class, it is mainly pictorial drawings. This story is about a Navajo family planting and harvesting corn. The book is written in the Navajo language with only a short sentence under each drawing and will be read in Navajo. At the end of the story, it will be translated into English. Naadaa is the Navajo word for corn. One part of the corn is the tassel. When it is ready, the tassel is lightly shaken into a bowl. From that, a cheese cloth is used to shake the pollen off the tassel, and it is collected into another bowl. The pollen is bright gold yellow and is used during traditional prayers. It is one of the sacred parts of the Navajo culture.

Each student will put on aprons prior to stepping outside the classroom. One grinding stone will be used, a metate. For this activity, any color dried corn may be used. The roasted blue corn used for the actual cooking will be purchased from the local grocery store. Students will get five kernels from a bag to place on the metate. They will then use the stones to grind the kernel into a powder form. Body form is important when

grinding; the students must have straight posture, just like performing CPR, with their back straight, arms straight and leaning forward. It will take 5 minutes for each student to perform this task. Once the grinding is complete, students will clean off the stones with a soft brush before storing them. They will write in their journal their experience and will also sketch a drawing of the process or product, such as drawing themselves grinding or drawing the ground corn.

Grinding stone and corn -Figure 2.[12]



Day eight

Activity 3 - Making Blue Corn Mush

A 2-minute YouTube video about making blue corn mush will be shown to the students, so the visual learners will get an idea on what is expected in today's lesson. Safety instructions about the kitchen rules will be reviewed. All students with long hair will need to tie their hair back and take off any pullovers or hoodies prior to washing their hands.

Cooking instruction will be given to each student with a step-by-step process, in written and picture form. The class will get the necessary cooking materials needed to make blue corn mush. They will each get an apron, small pot, 2 cups of water, 1 tsp. of juniper ash, small mixing bowl, balloon whisk and 1.5 cups of roasted ground blue corn. The first step is pouring 1 cup of water into the pot. Put the pot on the range and set temperature to medium high. Add one teaspoon of juniper ash to the pot. In the mixing bowl, add 1 cup of

water and then slowly pour the ground blue corn into the mixing bowl while mixing it with the balloon whisk. Mix until the substance is mushy. The pot of water should be boiling now. Mix the ash and water. Pour the blue corn mix into the water. Constantly stir using the whisk. You may bring down the temperature to medium at this point. Mix until the substance resembles Grits or Cream of Wheat. Remove from the stove.

At the completion of the cooking lesson, students will get to taste their mush. Berries, bananas almond slices and honey will be available for them to add if they choose. They will each document in their journal the taste, texture and color. A final sketch of the bowl of blue corn mush will also be entered into their journal. Students will complete a Reflection page of their project.

Blue corn mush with toppings. – Figure 3.[13]



Bibliography

Robert L.Wolke, *What Einstein Told His Cook* (W.W. Norton & Company Inc) 2002.

This is the book that was used for the YNI seminar.

Lyrae, Willis. *Tree Vitalize, 25 Different Types of Juniper Trees & Their Identifying Features*. August 27, 2025.
<https://treevitalize.com/types-of-juniper-trees-identification/>

This article names the types of Juniper worldwide. I found the name of the Juniper that grows in the U.S.

Southwest region. Navajo people have used the Alligator Juniper ash to add to meals. Primarily used for its nutrients.

Schulze, Eric. Serious Eats, *An Introduction to the Maillard Reaction: The Science of Browning, Aroma, and Flavor*. May 13, 2023. <https://www.serious-eats.com/what-is-maillard-reaction-cooking-science>

How does baked or grilled food fill the atmosphere with a delightful scent that makes your mouth water? Baking yeast bread or grilled steaks makes the food browned or charred. This reaction is very common when cooking and students will need to know the reaction that occurs is called the Maillard Reaction.

Falkingham, Tom. Bee Clean Soap: *What is Lye? All you need to know!* May 25, 2022. https://www.bee-cleansoaps.co.uk/blogs/what-is-lye-all-you-need-to-know?_pos=5&_sid=eaa9b4b38&_ss=r

Students will understand that Lye is the reason soap works to remove dirt or grime. Wood ash is a powerful component and has been used since the 1800's. Lye is needed to make the bar of soap hard.

Helmenstine, Anne Marie. ThoughtCo, *Physical Changes in Chemistry*. August 5, 2024. <https://www.thoughtco.com/definition-of-physical-change-605910>

Students whose low comprehension level will need to understand the basic difference between physical and chemical change. This article provides simple examples that students will relate too.

Helmenstine, Anne Marie. ThoughtCo, *Chemical Change Definition in Chemistry*. August 2, 2024. <https://www.thoughtco.com/definition-of-chemical-change-604902>

A clear definition of chemical change that is not reversible. A new chemical component is formed, in this case, when cooking.

9-12 Dine Character Building Standards.
<https://oscad.navajo-nsn.gov/Portals/0/FILES/Programs/Dine%20Character%20Building%20Standards/9-12%20Dine%20Character%20Building.pdf>

I teach on the Navajo reservation, and we are strongly encouraged to add in Dine Standards in the core contents. There is also a Cultural Center on the school campus that is open for projects, stories and lectures.

Hoyt-Goldsmith, Diane. *Migrant Worker A Boy from the Rio Grande Valley*. Holiday House – New York. 1996.

This book is about a migrant 11-year-old that works at the fields during the summer months, spending long hours picking crops to earn money with his family. Navajos also are agriculturists; they can relate to working with the fields or livestock during their summer break.

Hruby-Powell, Patricia. *Zinna: How the Corn was Saved*. Library of Congress Cataloging-in-Publication Data. 2003.

This story aligns with the Dine Standards. The story involves one Navajo deity, also known as a Holy person in Navajo Culture. Spider Woman is part of the Navajo Creation story and is commonly known for the rug weavers. In this story, Spider Woman is sought out for her assistance with the failing crops.

Lopez-Ridaura, S., Barbara-Escoto, L., Reyna-Ramirez, C. A., Sum, C., Palacios-Rojas, N., & Gerard, B. *The*

Three Sisters of Indigenous American Agriculture. USDA National Agricultural Library.
<https://doi.org/10.1038/s41598-021-82784-2> (2021)

A variety of Native tribes use this method, growing corn, beans and squash together. Students will understand how each help one another survive and flourish. They may share prior background knowledge of what they grow in their vegetable fields.

Youkin, Lainey M.S., RD, LDN. *Are Grits Healthy: Here's What a Dietitian Says*. EatWell. May 20, 2026.
<https://www.eatingwell.com/article/7891738/are-grits-healthy/>

Grits are similarly prepared the way blue corn mush. Both require the use of a stone grind to turn the dried kernel into powder. Students will learn that Grits are a Southern favorite and its health benefits. Grits are not a common dish on the Navajo reservation.

Warwick, Kathy W. *Is Cream of Wheat Healthy?* Healthline. March 4, 2020.
<https://www.healthline.com/nutrition/is-cream-wheat-healthy>

Cream of Wheat is served in our local cafeteria at least 2 times a month. Students will see that Cream of Wheat and Blue Corn mush are made identically. Understanding the health benefits may also help them to choose the Cream of Wheat at breakfast time.

Appendix: Implementation of District Standards

This unit will include the Arizona State Academic Standards

English Language Art: Reading, Writing, Speaking and Listening. Students receive a variety of hands-on, visual and tactile activities to aid in their comprehension. (Key Ideas and Details, 2.RL.1. Research to Build and Present Knowledge, 2.W.7)

Science: 1.E1U1.5 Earth and Space Science Standard. Students will gain an understanding that earth materials are natural resources for humans in their everyday lives. Students will learn the difference between physical change and chemical change through cooking.

Dine Character Building Standards: Students will demonstrate their understanding on the Dine language and customary practices. C.4.PO1. Students will make a native dish. Identify the uses of natural resources from our surrounding land that provides food. The Cultural Center coordinator speaks in Navajo and will read one short book to the class that's written in the Navajo language about crops.

Math: 3.MD.A.2 Measure and estimate liquid volumes. Students will need to find the grams per cup for carbohydrates, fats and proteins. They will measure in cups and teaspoon for the final cooking project.

Post-Secondary Transition Components: this is to ensure students with an Individualized Educational Plan (IEP) receive activities towards their Transition goal in Education, Employment and Independent Living. The students will ask any of their extended family members about home recipes. This will be included in their life skill activity, cooking simple meals for themselves.

Notes

[1] ThoughtCo

[2] ThoughtCo, Chemical Change Definition in Chemistry

[3] Serious Eats, An Introduction to the Maillard Reaction

[4] Bee Clean Soap

[5][5] USDA National Agricultural Library

[6] Tree Vitalize

[7] Tree Vitalize

[8] Navajo Nation Government Standards

[9] EatWell

[10] Healthline

[11] This picture of juniper tree is from Navajo Mountain, the sifter and ash are from my kitchen. My parents live in Navajo Mountain.

[12] Pictured is the grinding stone used for dried corn only. The colorful corn are from my cornfield.

[13] Pictured is Blue Corn mush that I made with additional toppings added.

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