Human Body: The Marvels of Physic, Chemistry, and Biology working together

GMO: Is it a Toxic Food Term?

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Diné Institute for Navajo Nation Educators (DINÉ)

2019

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Introduction

In reality, whether we accept or deny obesity, it is a health concern at the national level, prevalent among the Native American communities. According to data from the National Health and Nutrition Examination Survey, in 2013, "more than 1 in 3 adults were considered to have obesity, 1 in 13 adults were considered to have extreme obesity, and about 1 in 6 children and adolescents ages 2 to 19 were considered to have obesity (Ogden, C. 2017). This national epidemic of obesity parallels with Native American communities leading to a variety of chronic diseases; such as diabetes, respiratory diseases, cancer, heart diseases, etc. (Broussard et al., 1995).

We became fascinated with food, from its production to consumption, yet impulsively we indulge - jeopardizing our health. Everything humans consume have been grown, raised, and processed typically in the same way. We use some type of science to transform plants and animals into food with simple to complex agricultural technology. Some foods do require additives and dietary supplements to make it nutritionally enhanced. In addition, preservatives were added to enhance shelf life of foods that typically go bad within days. It is apparent, industries have taken precautionary measures for potential risks that GMO foods may present. One potential health risk is from the probability of developing allergenic food protein growing from nonallergenic food source with each growing season. This means there is possibility for allergic reaction. Another belief is GMO foods can contribute to the development of some types of cancer, the disease involves mutilating DNA, causing a risk because it introduces new genes to the body (Jumba, 2009).

I realize biotechnology is a thought-provoking concept. Everything revolves around science. My most recent experience was through my curriculum project called Chemistry of Cooking for the Yale National Teacher Initiative program. Science has always been taught from various science textbooks. Students become bored with text book information that don't make sense to them. They tend to grasp information with hands-on experiments. My strategy for this science curriculum is to give a basis by inspiring and engaging my students into the science world. In addition, also integrating the Diné Culture, History, and Language will provide interpretation to better understand the impact science has around them. Although, our current textbooks do not adequately focus on food, health and chronic diseases, I feel my primary curiosity of food provides a learning tool for our children.

Learning about GMO and its controversies can be exciting for fifth grade students, yet at the same time, scary too. The concepts and ideas about this unit, as well as most information on the production and consumption are difficult for most people to understand, particularly young children. In preparing the organization of this unit, it is important for me to gain as much content knowledge to best facilitate the learning process for my students. I realize there are going to be many challenges throughout this unit. One challenge essential to the unit is honesty, by being upfront with the students at all times, even if the information is appalling to them. The goal of

this unit is to deliver content information related to food awareness so students can have a greater understanding.

This unit is designed for fifth-grade self-contained class. Arizona State Science Progression Standards focuses on integration of science and engineering practices. The duration of this unit is approximately 90 minutes per day for three weeks. The unit will bring awareness to the students about the benefits and controversies of using genetically modified organism, and its potential risks which impact people with medical condition (obesity, diabetes, asthma, etc.). The activities and experience will be interactive, dissemination of information, understanding issues, engaging in real world problems, and higher level thinking, small grouping to think-pair-share, debate, discover, design, create and build will be strategies promoting this unit.

Demographic

The small town of Kayenta, is a remote community with a spectacular scenic beauty. To the north is the "Five Toes." Reddish sandstones hills feature prominent Navajo Sandstone and the Kayenta Formation for its geological layers. It is also known as the gateway to Monument Valley, Utah, one of the 8th Wonders of the World. A cultural tourism for visitor to learn through stories from storytelling and local tour guides about the land formation and history. It is a place where locals, market their prize arts and craft to tourist. Kayenta's population is a little over 5,100 located in the northeastern part of Navajo County, Arizona. It is the only Navajo reservation town that operates like a city-type government. It sits in a valley below the beautiful mountain range of Black Mesa. Atop is the country's largest coal mine operation. Coal mining providing the primary economic activity for the area (http://kayentatownship-nsn.gov/Home/index.php/community-development, 2014).

Looking back in history, Kayenta had its first trading post established in 1910 during the time the first settlers moved into the area –The Wetherills. The community phased through a major development since then with numerous gas stations, restaurants, a grocery store, hardware store, and lodgings (http://kayentatownship-nsn.gov/Home/index.php/community-development, 2014).

Two years after the first Trading Post opened, the post office was built. A year later, Marsh Pass School, first school was completed. Dirt roads turned into pave roads as Kayenta Public School and Kayenta Boarding School opened. Kayenta Public District #27 began in a one room classroom in 1930. Today the school serves 1,715 students Pre-School, K-12 in four school buildings. 90.2 % are Native American. The school's dropout rate is 4 percent for 9-12 grades (AZ School Report Cards, 2018).The class size ranges from 23-28 students per teacher. School lunch is free for all students through grant funds, complying with the nutritional guidelines of Federal school meal standards.

Kayenta Middle School serves grades 5th- 8th with a total of 523 students: 94.84% are Native American. (AZ School Report Cards, 2018). Nine percent of the student have an IEP. Fifth and sixth grades classes are self-contained. Seven and Eighth grades classes are departmentalized with 7 periods. KMS offers a period of elective class in music, P.E., Technology, Navajo Language, STEM class, and Art. Students' class schedule changes every quarter. KMS

celebrates student success each quarter. Eleven to fifteen percent of the student population are recognized for their academic success each quarter.

Majority of my fifth grade students are Diné, though not all of them speak the Diné language fluently. Their families do show great interest in learning their Diné Culture, History, and Language. My class consisted of 22 students, 12 boys and 10 girls for this school year, two are in the EL program and 1 ESS student. An average number from my class come at different learning levels with some having significant gaps in knowledge and challenged learning behaviors. My students are part of the Lowell Observatory program. The program provides a partnership between Lowell Observatory and Kayenta Middle School to develop astronomy–centered lessons to be used in the classroom. The lessons are intended to help students find science and engineering exciting and fun. These students become curious learners who desire meaningful, fun, and engaging content.

Rationale

It is absolutely important to convince students to become knowledgeable consumers because the food they eat affect who they are as human beings. Young consumers unconsciously exercise their economic rights by buying food based on looks and taste, peer pressure, and the convenience of processed food. Most students have a fair knowledge of nutritional requirement for a healthy body; still, food choices they make are unhealthy. This behavior is a concern. Young consumers' nutritional knowledge and good dietary habits are unbalanced. This leads to health implications of obesity, diabetes, heart diseases, etc.

As we moved into twenty-first century, technology and social media are completely transforming the restaurant experience and our relationship with food. Meanwhile advancements in fine-tuning and altering the genes of crops grown for taste and nutrients is popularizing. Even grocery shopping has become complicated. Do you want conventional food, non-GMO or GMO foods, no MSG, or gluten free? What about organic or inorganic foods? Do you want to save money, take advantage of discounts, and are you looking for what is on sale? Further, are you worried about food safety – allergic or nonallergenic food? Your mind is bombarded with choices!

The current lifestyle dominates the Diné children's mentality with a feeling and view that our Diné culture and tradition is inferior and so they easily prefer the exposure of Western ideology. In our Diné history, traditional stories have set challenges or warnings of losing our cultural teachings and values. In Lorenzo Max's lecture, "Hózhó – making our state of being strive toward and maintaining balance with harmony and peacefulness in the Universe." We, the Diné people, have persevered through our chaotic past to make us resilient people. Our teachings must connect to the younger generation of our Diné, by envisioning, molding them to be leaders by embracing our traditional teachings to restore health and affirm cultural identity so we can live a long and healthy life through nurturing of Hózhó.

"Dietary shifts is one main dimension obesity has increased dramatically." (Lomboard et al, 2006). There are many other contributing factors to onset obesity and diabetes. One is drastic increased consumption of processed foods, poverty and unemployment, and limited access to healthy food. In addition, commodity programs still contain unhealthy ingredients, readily available foods at trading posts and convenience stores are also the blame for rising rates and last, poor physical exercise impedes on a healthy lifestyle. (Lomboard et al, 2006).

I want to inform my fifth grade students of these health risks, with obesity and diabetes trending among adolescents at the school population and in their class. Furthermore, there is a strong connection between obesity and diabetes which links to an unhealthy diet.

This unit will teach students to have awareness of the benefits and controversies of using genetically modified organism, and its potential risks, which impact people with medical condition (obesity, diabetes, asthma, etc.).

Objectives

Students need to understand where the food they eat come from, the choices they make drive the food economy to produce more. They may not realize their unintentional act is empowering society. For this reason, it is essential we reach young consumers to educate them about their food choices, their consumption and direct them to the basic food groups. This unit will provide relevant and meaningful connection of health science for students. Students will have general knowledge of nutrition, diabetes, and obesity. Students will learn what is Genetically Modified Organism (GMO) and what is not GMO? GMO is present in our food. They will recognize the benefits and risks of GMO. Further, students will learn what and how new innovation in technology plays an important role in GMO foods. Lastly, they will learn about food labeling; about 40 crops having components of GM in the U.S and without food labels. As a result, grocery shelves are filled with 60-70% of genetically engineered products.

I envision how it will teach Diné children to gain understanding of where the food they consume comes from, how it is grown, and basic understanding of the genetic engineering of food. I feel this topic is an eye opening matter. There is a need to foster their thinking by engaging them in creative thinking to synthesize knowledge and experience every time they enter a grocery store. They have the opportunity to purchase GMO or Non-GMO products. Hopefully they understand growing their own crops some day is the best choice for them.

Content

History of GMO (Genetically Modified Organism)

Prehistoric farmers had practice in selecting the most productive seeds and plants from their domesticated crops for some 10,000 years.

Concept of genetics was unknown to our ancestors, but in some way their method influenced DNA of other organisms through process of "selective breeding" or "artificial selection". This method of artificial selection from plants dates back to 7800 BCE. https://geneticliteracyproject.org/2015/08/12/gmos-from-ancient-history-to-the-future/

Genetically Modified Foods has been a method known to produce food back to the mid-18th century. Gregor Mendel, an Austrian monk and botanist, was known as the first scientist to crossbreed tall pea species with short pea species. His introduction of "crossbreeding" did not resurface until the 20th century. In 1856 to 1863, Mendel studied thousands of plants and in his studies he had experimented that peas offsprings are quick and easily produced. So he crossfertilized green and yellow, tall and short, smooth and wrinkled, and discovered Law of Segregation that established a dominant and recessive traits inherited independently from parent to offspring. In 1865, he hardly gave attention to his work that it dimmed away and other scientist overlooked his work because other scientist thought his experiment on plant hybrids had little validity. In time 1900, his work was applied to certain species and types of traits, and his work became known as Mendel's Law. As genetic theory evolved, Mendal's work was thought to be applicable to many geneticists, botantists and biologist work on heredity (https://www.biography.com/scientist/gregor-mendel). Fortunately this paved the way to discover the physical and chemical composition of the gene -DNA. The understanding of genes then led to altering and controlling them. Further, the methods of genetically engineered plant was first found applicable to GMO in food production and medicine. In 1854, Friedrich Meischer, a German chemist discovered the element of DNA, Deoxyribose Nucleic Acid. DNA is known to carry vast amount of genetic information and uses only four chemical "base pairs," A-T and G-C, to produce proteins displaying genetic differences. This is one device discovered a new sequences to generate a desirable effect in a living organism. This created genetically modified organisms (GMOs). 1944, Oswald Avery confirmed DNA is a true carrier of molecular information and more. In 1953, James Watson and Francis Crick confirmed and defined DNA's structure as a double helix. With this information it paved way for genetic engineering (Harvey, 2019).

In 1970, Monsanto, a chief agriculture company located worldwide, who now controls most of the seeds industry hired chemist John Franz to develop herbicide later known as Roundup. https://www.medicaldaily.com/brief-history-genetically-modified-organisms-prehistoric-breeding-modern-344076

Early 1990s, a California company, Flavr Savr produced the first commercially grown GM food crop – tomato. The company genetically altered tomato to help with decomposing longer after being picked. In 1992, Stanley Cohen and Herbert Boyer introduced gene splicing. It made it possible for chemically cutting and splicing strands of DNA at specific places in the sequence.

Some of the first known GM foods are papayas, milk, corn, tomato, soy, squash, and zucchini. These are among many of the GM foods. www.newsmax.com/Health/Health-Wire/genetically-modif…

GMO has a very long history – it has been utilized for thousands of years. Cross-breeding has been the most effective method known for best crop. Cross-breeding is when a new gene gets inserted into a crop which otherwise wouldn't be what it is today – larger, tastier, and sweeter for the satisfaction of human consumption.

12,000 years ago, humans have been known to alter food and its genes. Farmers have strived to improve their crops durability, have resistance to diseases and pests in their own natural way. Over the years when harvesting, farmers look for certain qualities in their crops, then began molding crops to what they think is best for crop – larger, tastier, and juicier. For example, sweet potatoes raised some 8,000 years ago used parts of swollen regular potato roots and were modified and grown into sweet potatoes. Potato did not become sweet on its own, it was altered into grown sweet. https://www.medicaldaily.com/brief-history-genetically-modified-organisms-prehistoric-breeding-modern

United States is the largest producer cultivating many modified crops to meet the needs of growing population. Nutrineat.com states in 1997, 4.2 million acres of area surface land was being utilized for modified crops and as of 2009, it has grown to 331 million acres. This production of cultivation counts for 45 percent of the world production. (https://nutrineat.com/history-of-genetically-modified-food, 2019)

The most transformed plants was soybean and maize. Potatoes, tomatoes, cotton, tobacco, animals such as cattle and pigs were included in this transformation.

GMO (Genetically Modified Organism)

GMO is taking a gene from a plant and animal and implanting it in another species for potential improvement of the food worldwide. With innovation of technology, crops are able to increase rapid growth to ripen crops faster, provide for longer life, increase nutritional content, juicier and larger, insect resistance, and prevention of weeds. Further, the rationale for altering the structure of these genes provide for development of pharmaceutical preparations important to clinical experiments proven significant to gene therapy and insulin for diabetes (Moran 2013).

Genetic engineering

Genetic engineering is manipulation of genes present in crops and animals to change the genetic material – biotechnology. The production of breeding focuses on hormone, growth rate, and increase in body weight. The negative effects on human and animal affair such as forcing animals to eat GMO feeds and causing animals to suffer from health effects. For example, accelerated growth can have a degenerative bone growth. It also has a negative effect on the environment where farmers are spraying herbicides on weeds and invasive plants. Human and animal cloning is based off of research collaboration. The important purpose is to learn about genes that contribute to diseases and for organs to save lives. The U.S. Government is in a

position against human cloning because cloning is not natural but more of an invented product manufactured by a scientist. Human cloning strips the nature of a person. In addition, human cloning can be disasterous. If all human beings were made up of the same genetics, a single disease could wipe out the entire population. Therefore, cloning may be best with animals for research basis. Cloning can help save endangered species, by producing a special breeds and/or for food production and consumption (Brown, 2001).

This is a controversial method due to the negative effects it can have on animals and humans. On the other hand, genetic engineering can be a benefit. Gene therapy is used to treat genetic defects, innovation in vaccines to treat diseases, and agricultural benefits of pests' resistance and nutritional content.

DNA (Deoxyribose Nucleic Acid)

"DNA is a substance that carries genetic information in the cells of plants and animals." (Webster Dictionary). DNA is found in all cells, each cell is tiny and has its own job, with a complicated process that makes the genes. DNA is arranged as a double helix in the nucleus, it is the cell control center. It holds the genetic instructions for producing proteins. Inside the nucleus is where it decides the entire structure and function of the cell – growth, reproduction, and storage of genetic material. (Bailey, 2019). Cell is basic component of life. Cell structure consist of organelles and tissues. There are many of them. They are all different. Their task is carrying out necessary functions for organism's survival. Some cell structures are responsible for transport, production and disposal. Single cell are called unicellular and living organism with a collection of cells are called multicellular organism. Cell can be eukaryotes or prokaryotic. The nucleus of euraryotic cells controls the movement, stores DNA, and distributes proteins that each cells needs to survive. Cells uses stored genetic information in DNA to perform expressed activity by the individual genes. The cells respond to their environment and demonstrate cell growth and division (Champagne 2007). A type of nucleic acid, a biomolecule consists of three parts - sugar, phosphate, and base. The base codes for your trait are the four bases; adenine and thymine, guanine and cytosine (Webster Dictionary, 2019).

How GMO is made

Scientists are influenced by nature in hopes of finding solutions to world hunger and health problems. Scientists look to plant organisms to search for trait that would allow a crop to sustain in specific environments and improve the nutritional content. First, scientist identify a specific trait of a plant. Their interest is looking for ways to produce nutritional need. This method happens through a trial and error period. For example, Golden Rice was designed to produce pro-Vitamin A which many developed countries need to improve health outcomes in a cost effective way. A corn plant was identified and searched from a list of variety which may contain this trait. After screening corn plants of this sequence a gene is identified that meets the nutritional value, the genetic trait is then isolated and inserted into a new genome. As time goes, we develop bigger and better crops in a short period of time – known as a "frankenfood". Along the way, invention of technologies to fight pests, diminish pesky weeds, and higher nutrient content. However, unexpected risks can materialize relating to environmental and health risks such as

allergic reaction and loss of nutritional content. Nevertheless, the genetically modified foods fill the shelves in grocery stores across the country (Powell, 2015).

Benefits of GMO

By 2050, world population is estimated to be 9.2 billion. For this reason we need to figure out how to feed the global population. In order to have adequate supply of food, crops have been engineered to grow in large quantity with nutritional content. Of course, our environment and health issues will be problematic. Although, we have technological advances, natural disasters and climate changes also exist. Another benefit is the use of biotechnology to manipulate the product to achieve abundance of food supply. In this case, products can be made to ripen faster, bigger, herbicide and drought resistant, tastier, juicier, weed tolerant, virus and soil bacteria resistant, less bruising, longer softening of products and nutritional enrichment (Hug, 2008).

Risks of GMO

There are many potential risks from genetic manipulation of foods. One risk is triggering an allergenic reactions from new expression of proteins from different foods. Some children are subject to unintentional intake of food from ingredients with foreign proteins in places like restaurant or when staying with relatives or friends. The danger of altering foods could transfer foreign substances during processing too. Most food allergies are caused by abnormal immunological or gastrointestinal problems. All known food allergens are proteins and only a small portion of proteins are allergenic. Therefore, "all foods containing such proteins would need some type of labeling to protect allergic children." (Cantani, 2006). A panel from Royal Society of Canada reports, GM foods' composition breakdown is the same as a non-GMO food, therefore, considered to be as safe as non-GMO foods, even with foreign protein content (Cantani, 2006). Because of scientific language in most studies, it is hard to tell if GM foods are safe. For this reason, there are concerns for food labeling. Speed processing of foods with genetic engineering is used to create new foods with desirable traits – such as being more nutritious, tastier, juicier, prevention of diseases from drought resistant plants, use less of pesticides, reduce cost and longer shelf life, less cancer causing, and medicinal foods provides for vaccines and other medicines. This could also be a benefit for GMO (Kramkowska et al, 2013). However, with genetic engineering the risk is in its production of foods. The processing of food could create other unknown side effects. Some plants and animals could possess a toxic or harmful effects. In addition, genetic engineering commonly transfer proteins into the food supply from organisms not approved or have been consumed as food. (Hagedorn, 2000). Another risk is accidental release of substance into the environment during laboratory handling and controlling by producing harm like "tampering with Mother Nature." This risk is highly possible because of the popularity of GMO industrial plants and for economic means. Another risk is the development of antibiotics resistance. The risk occurring when transferring genes to antibiotics to GMO producing negative health effects – "pathogens inducing various diseases may develop a stable lack of sensitivity to a specific antibiotics, resulting in lowered efficacy or total loss of effectiveness of respective treatment." (Kramkowska et al, 2013).

Diné Teaching

In oral stories, Diyin Diné'e (Holy People) provided sacred gifts essential to mentoring and molding our people to prosper in this Fourth World. It is told, T'azhii (Turkey) brought seeds from the Lower World - Hajíínáí. The primary seeds were corn, beans, squash and tobacco, known as the Four Sacred Food and our source of planting. In time, corn became the primary crop for the Diné people. Families tended to cornfields and incorporated various dry farming methods, eventually leading to cornfields being passed on from generation to generation. Without Turkey's action, our people would experience starvation during the winter.

Organic seeds provide a staple agriculture, where we must maintain a genetically safe source for future generation. These native seeds need to be saved and protected, there could be a tremendous loss of genetic diversity in coming generation. Non-genetically modified seeds are disappearing from the world.

Many of our younger generation do not realize the bigger picture of genetically modified seed and hybrid plants. We could be sharing information through a community garden from heirloom non-hybrid, non-modified vegetables that produces great tasting produce, and risk factors of contamination. Today, only our elders are knowledgeable of traditional seeds and plant diversity. The teaching is not passed down because young generation do not understand the importance of carrying on the tradition. They may or may not realize the crisis and they are the generation to pave the path.

Some hands-on activities includes using KMS greenhouse for spring planting of corn, beans and squash, planting style of dry farming or using a raised garden, harvesting and sharing fresh vegetables and by making herbal tea. More related topics include discussion comparing indigenous foods and nonindigenous foods. The impact of foods on our health and well-being.

In the tradition of our ancestors, Diné family should be saving the best of our heirloom seeds to ensure a strong foundational root system. In this practice we can rejuvenate and sustain our health, our culture and our people.

Food is life; without food and water, there is no life. For that reason, food is a big part of our culture, history and teaching. Helping to ignite a foundation for future generation is the most exciting part of the big picture of the culture – integrating a simple garden and sharing of stories.

Strategies

K-W-L chart is a graphic organizer to assist students in organizing information before, during and after the reading activity. This is a new topic and the information is complex, therefore, to motivate prior knowledge and help with brainstorming questions about the topic. Column 1 marked K stands for Know. What do you know about the topic? Column 2 marked W for what, who, where, why, when, how questions. Column 3, marked L stands for Learn. This column will be completed later in the unit – will be noted What did you Learn? In this column students will add information of what they learned after several lessons.

Literary and Vocabulary

Students will read aloud short picture book, Monsanto picture book teaches kids about the wonders of biotech by Jess Zimmerman and Anti-GMO book for children by Myles Power. These books describes how genetically modified organisms (GMOs) put our health and environment at risk. The reading activities will be a guided read aloud and some section will be assigned to small groups for discussion. Basic questions about the topic and vocabulary words will be written on the chart for students to think and discuss during pair/share activity.

Students will also explore expository text. This strategy assists teacher to be more interactive in the instruction and ensure students are comprehending the text, including vocabulary words. Vocabulary words in Diné Language. This will also entail complex information. At each page questions will be prompted allowing students to collaborate and note key details in their journals. After discussion teacher will check for understanding and correct any misunderstanding.

Videos

To stimulate the activities, short videos "What is GMO?", "Pros and Cons of GMO," will be utilized. This approach and attention to details will best be communicated for better understanding and experience of the topic. Of course, students are surrounded by media almost every day of their lives. This is a great way to review what they have been learning about. It also provides for students to be proactive and give their opinion.

Simple engineering science lesson

A modified method of Engineering Design Process will be adapted for this lesson. It incorporates STEM – build and Engineer, and teaching and learning of a step-by-step method of investigating problem by creating something tangible with a specific function as a tool to finding possible solutions. Students are provided to ask questions (What is the problem?), imagine (What are some solutions?), plan (Draw your plan and create something.), create (follow your plan and create something), improve (What works? What doesn't? What could work better?). This approach helps students explore with building things using science, math and technology. Their learning is enhanced with real-world problems and the best part is there is no real wrong answer in engineering. It's a hands-on, project based learning for enhancing engineering (EiE, Museum of Science, Boston, 2019).

Activities

Week One:

Objective: 5.SL.1c Pose and respond to specific questions by making comments that contribute to the discussion and elaborate on the remarks of others.

Students will begin exploring pictorial walls. The pictorial wall will depict a wall full of portraits or posters focused on processed foods and other GM foods. This will grab students' attention and engage them. Then respond to the question "What is Genetically Modified Organism?" using K-W-L chart. Student will engage individually and write down what they **K**now about (GMO). Next students will watch a video on "What is GMO?" As the video presentation is happening, students will be focus on taking notes of key details and at each pause students will engage in a

Think and pair/share to come up with a question. They will enter their question in the **W**hat do I want to know? Teacher needs to monitor this activity closely so the questions ideas accurately addresses the topic. Last, What I **L**earned column will be completed later in the unit as more information is shared and students will also have an opportunity to return to this activity as needed.

Objective: 5.RI.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. Students will read "History of the cell: Discovering the cell," and "Issue overview: Gene Editing." To continue to prep students thinking on the topic – here students will learn key ideas and details. Students will read and annotate the text. They will be in group of fours. There will be a reader, highlight notes person, question prompter, a timer for discussion. At each pause students will record discussion notes. When groups are done with reading activity, teacher will do whole class discussion using text-dependent questions. For closure, students will reflect on the articles and write a short paragraph that explains the central idea of the article and use at least two details from the article to support their response with evidence.

Diné Cultural Awareness

Diné Standards 3: Culture – Iiná

Students will obtain general knowledge of traditional Native American values and customs for healthy living – explore the culture and historical information associated with traditional preservation and preparation of native food. Student will listen to the story "*T'azhii brought the Seeds to the New World."* Students will discuss with the grandparent/consultant about traditional corn, squash, and beans seeds. They will compare and contrast with hybrid and genetically modified corn, squash, beans seeds. They will examine each seed very closely and note the difference. Students will reseach nutritional value. Next, student will select one traditional food or snack, the seed is coming from and create a dish to share. Home-school connection: student will share information with parents and grandparents. The food preparation planning will happen at home and student will report back to class. Student will note the recipe and add information where the food came from. They will also be encourage to learn the traditional food story from home and share orally in class. The day of the traditional food celebration, students will share what they learn about their food. Each activity will be guided with important nutritional facts, traditional story, and how it distinguish from modern day dish. There will be plenty of vocabulary terms of Diné Language learning.

Week Two:

5.SL.1d Review the key ideas expressed and draw conclusions in light of information and knowledge gained from the discussions.

Students will watch two videos. "What is GMO?" and "Pros and Cons of GMO." As video presentation is happening, students will be focus on taking notes of key details and at each pause questions will be explored. Students will continue to add to their notes about the topic.

5.RI.4 determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 5 topics and subject area.

Students will continued to explore vocabulary words that are critical for understanding content. They are words already in their notes, articles and on vocabulary chart. Students will work in pairs and be assigned 3 words. Students will sketch a diagram and label word, write briefly what it is, how it works and how it connects to other words. They will lay it out on a poster size chart and posted it on the wall.

Week Two & Three:

5.L3.U1.9 & 5.L3.U1.10 construct an explanation of how genetic information is passed from one generation to the next and based on evidence that the changes in an environment can affect the development of the traits in a population of organisms.

This will be a structure lesson. Students will work off teacher guided Definition and Discovery activity. What is DNA (Deoxyribonucleic acid? Why and how is it an important recipe to GM foods? Students will learn the term DNA. They will begin by learning the definition through mapping strategy for the term. Then move on to learning how it works? They will use a Description graphic organizer. Description strategy involves brainstorming characteristics and examples. Since DNA structure is a complex concept, Description helps to make it easier to group the concept from their description notes. They will watch a video "Genetically Modified Organisms" from YouTube. The video explains and demonstrates a creation of how a GMO goes through genetic modification. Using the Description notes, students will engage in creating a simple DNA structure of themselves. Here they will experience genetic engineering as they modify their own characteristics using hair color, eye color, nose shape/size, ears shape/size, height and weight. Next they will begin building DNA with a modified characteristic of themselves. They will use Lego (various colors) to represent their characteristics. Introduction of building blocks (bases); adenine (A), cytosine (C), guanine (G), thymine (T) will be discovered. Order and sequence to form the bases of instruction in the genome will be a way to explore the shape "double helix" like a ladder. At this point, students will explore the process of how GMO is produced. They will refer to how GMO is made and use the procedure to complete their DNA project. The procedure will be posted on the board. They will illustrate their final product of themselves and share with the class what characteristic about themselves they altered.

Students will continue to explore Engineering Design Process, as they complete another lesson/project of GMO. In small groups, students will select a vegetable or fruit from a picture file. First, they will identify a problem with the fruit. It could be about the taste, sweet, sour, juicy, size, shape, soft/hardness, seed, smell, color, last longer, bruises, spots, nutritional value or environmental implication. They will select one and determine what is needed to make it better by a consensus. Then brainstorm just how the product will be improved. Here they will have access to internet to do a little research about their product. With information gathered, they will write out how each team input is useful in solving the problem. Next, Design phase, after

collaboration, team will draw out their design (steps) and decide what material is needed at every step. Further, students will build their product out of material they listed in design phase. To begin, students will dissect their product and sketch and label inner core parts. Here groups may get into a confusion part of the lesson because some may take a step back and redesign. Some may do minor adjustments. Last, students will share their final product. Each group will also be allowed to use their cell phones to take pictures or video their work to use for final project. The overall goal is to create a more desirable produce for the consumer. The one genetic modification procedure used will be simply removing a gene from one location of a chromosome to a different location. This will change its expression level. Another procedure is inserting a whole new gene from another organism to allow the plant to make a protein that is normally not made by that plant. Once their experiment is in process, they will discuss how to present it to FDA (teacher) for evaluation for safety and nutritional characteristics of a GM crop before it is marketed (Ohioline. 2019). Next step, students will study GM food labels. From this they will decide to label or not label their product. At this point students will be expected to make a short video commercial to market their product. Although this experiment may not be real but the educational part is differentiating instruction for visual learners is important.

Assessment:

A final assessment will be the presentation of their product to the classmates. In addition, students will be graded on a lesson activity daily or weekly. The teacher will use Project Rubrics for final grading.

GMO Project Rubric

Group Names: _____Date: _____ Teacher: _____

	1	2	3	4
Content * Information clearly relates to topic *Thorough postings and added facts *Used 7 or more vocabulary words from project *Video presentation on topic *could answer most questions	Requirements missing* insufficient text or visuals or understanding of content	Most requirements present, sufficient text or visuals or understanding of content	All requirements presents* descriptive text*Caption informative and overall good understanding of content	All requirements present* well written text/labeling* visual designs work together and informs about content thoroughly
Design	Did not follow	Followed layout	Followed layout	Followed layout

*Notebook well organized with layout and group planning and notes *Notes follows EIE model	the layout sample, disorganized, demonstrates little planning; graphic are not related	sample, somewhat disorganized. some planning	sample, logical text, visuals are neat and easy to understand. Graphic organized and easier to understand	sample, logical and easy to read text, visual neatly designed and compliments content
Effort *Team work *Roles are clear *Use time wisely *problem solved	You all rushed through the project; did not use time to focus on project	You all put a little effort into the project; work some of the time on task; some disagreement	You all worked hard for most of the time; stayed on task; resolved relevant questions;	You all took your time and worked hard on the project; problem solved issues; excellent team work

Total Points: _____

Alignment with Standards

Arizona Department of Education - Life Science Progression
Core Ideas for Knowing Science – Life Sciences:

L1: Organisms are organized on a cellular basis and have a finite life span.
L3: Genetic information is passed down from one generation of organism to another.
5.L3U3.7 Ask questions about and explain how specialized structures found on a variety of plants and animals (including humans) help them sense and respond to their environment. This science standard is the framework of the unit developing and connecting their knowledge to the hands-on activities and informational text about the topic.

5.L1U1.14 Develop and use a model to explain the organizational levels of structures in multicellular organisms consisting of organ systems, organs, tissues, and cells. Students will build a DNA model to explain the cell functions, structure, and its characteristics. In addition, students will use engineering model for an activity in their project.

5.L1U3.20 Generate questions and/or predictions based on observations and evidence to explain cellular organization, structure, and function. Students will explore questions through out the unit of DNA study.

5.L3U3.9 Obtain, evaluate, and communicate information about patterns between the offspring of plants and the offspring of animals (including humans); construct an explanation of how genetic information is passed from one generation to the next. Project and informational text about heredity and traits will explored and supports genetic engineering and cloning.

Reading

Arizona's English Language Arts Standards	
Reading Standards for Information Text	
Key Ideas and Details	
5.RI.1	Quote accurately from a text when explaining what the text says explicitly and hen drawing inferences from the text.
5.RI.2	Determine two or more main ideas of a text and explain how they are supported by key details.
5.RI.3	Explain the relationships or interactions between two or more individuals, events, ideas, or concepts in a historical, scientific, or technical based on specific information in the text
Craft and Structure	
5.RI.4	Determine the meaning of general academic and domain-specific By words and phrases in a text relevant to a grade 5 topic or subject area.
5.RI.5	Compare and contrast the overall structure (e.g., chronology, comparison, cause/effect, and problem/solution) of events, ideas, concepts or information in two or more texts.
5.RI.6	Analyze multiple accounts of the same even or topic, noting important similarities and differences in the point of view they represent.
5.RI.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.
5.RI.8	Explain how an author uses reasons and evident to support particular points in a text, identifying which reasons and evidence support which point(s).
5.RI.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.
Range of Reading and Level of Text Complexity	
5.RI.10	By the end of the year, proficiently and independently read and comprehend informational text, including history/social studies, science and technological texts, in a text range determined by qualitative and quantitative measures appropriate to grade 5.

Teacher Resources

Arizona 5th Grade Standards. http://www.azed.gov/standards-practices/2019

Are GMOs Good or Bad? Genetic Engineering & Our Food. https://www.youtube.com/watch?v=7TmcXYp8xu4

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