Forest and Climate Change

The Upside Down Forest and Climate Change in the Betatakin Canyon

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Diné Institute for Navajo Nation Educators (DINÉ)

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Introduction

When I was young, I went on horse rides with my father. We used to ride to his grandfather's house at the base of the Mesa. I never knew my great grandfather's name, but my siblings and I called him "Old Man Coming." One day my father said, "Let us ride up the side of the Mesa and visit my father at Big Mountain." I said, "Ok, and how are we going to ride up there?" He explained that there was a horse trail we could follow and that would lead us up to the top. So we rode our horses to the east of the Mesa near my grandmother's residence in Owl Springs. We rode our horses without bringing food or water. I did not realize the ride would take most of the day. Before we reached the trail, we watered our horses, and drank as much as we could from the windmill trough, and then began our trek up the side of the Mesa.

While riding along the trail, my father talked about the land and how it helps sustain all living beings. He talked of how an abundance of mule deer, elk, wolves, and mountain lions had once roamed here. He said, "I rarely see them now because of the coal mine and because more people have moved onto the land." Later, he talked about plants like juniper and cedar trees, sagebrush, and shrub oak and how the animals and people share the land and the natural plants. It was enjoyable listening to my father talk about animals, plants, and land. While we strolled up the trail, I analyzed the natural scenery while my father spoke about particular areas close to where we lived. It was an excellent oral lesson from him. Unfortunately, I underestimated him and his knowledge because in my view he was a drunk. However, on this particular occasion he was sober and was himself.

As we continued up the Mesa, the sun was beginning to move west, and I was hungry. Apparently, my father was hungry too, and I watched as he pulled juniper berries from the trees and popped them into his mouth. I copied what he was doing and pulled off cedar berries from the tree and chewed them. They were bitter and I quickly spat them out. My father laughed at me and explained that I should only pick the purple berries and not the green ones. He said, "The purple berries are sweet and grainy," adding, "the Navajos used to crush the berries in pemmican to use as their traveling food." I had never known these berries were edible. That horse ride with my father and listening to his stories about the land, is the one good event which includes him that I will never forget especially because he is no longer with me. He passed away at the age of 33.

I want my students to know how land connects animals, plants, water, air, and the sun. These relationships are needed to keep all beings in balance. My fifth-grade students are at an age where they can comprehend the interconnections of Mother Earth's many resources. Most of my students are Diné/Navajo and unfortunately speak and understand very little of their own language and culture. Our school district is located in a semi-arid region in the northeastern corner of Arizona in the town of Kayenta. Kayenta does not have very many native trees like juniper, cedar, pine, and shrub oak. However, some of my students reside in outlying, isolated areas like Chilchinbeto, Black Mesa, Shonto, and Oljato where there are native trees.

Context and Rationale

<u>Demographics</u>

Kayenta, Arizona is in the Southwestern United States near the four-corner area of Arizona, Colorado, Utah, and New Mexico. The population of the town is 5,512 according to the 2010 census, and 93.4% of the community is Navajo/Diné. Kayenta is a rural community with fast-food restaurants, gas stations, motels, and one grocery store. The Indian Health Service Clinic and the Correctional Facility, which serve the local community and surrounding communities, have been recently constructed. Our unique town government is called the Kayenta Township. The township provides jobs and program initiatives that support the growth and sustainability of Kayenta. Departments and services like parks and recreation, tourism, land for lease, community development, ordinances, regulations, permits, and codes give the town an organized structure. The township also provides community spaces and events like the community garden and flea markets (known to be one of the biggest flea markets on the Diné Nation), and has community celebrations like the Toys for Tots, Fourth of July, and Veterans Recognition.

The primary employer in Kayenta is the Kayenta Unified School District which employs 500 to 600 teachers, bus drivers, kitchen and custodial staff, technology and maintenance workers, and teacher aides. The school district has four school sites: ABC Preschool (preschool and kindergarten), Kayenta Elementary (Grades 1-4), Kayenta Middle School (Grades 5-8), and Monument Valley High School (Grades 9-12). About 1,560 students attend the Kayenta Unified School District according to the school board minutes from June 2021. Many K.U.S.D. students come from outlying areas like Black Mesa, Chilchinbeto, Rough Rock, Dennehosto, Oljato, Cow Springs, Shonto, and Skelton Mesa. Students from Rough Rock travel about seventy miles one way, or one hundred forty miles each day, to attend school. This is too far for young students, especially during the hottest and coldest days of the school year. Nevertheless, these kids are amazing and resilient in enduring the natural elements and doing all they can to get to school.

I am a fifth-grade teacher and I work at Kayenta Middle School. The school has approximately 560 students and 35 teachers, tech-aides, custodians, counselors, and other staff members who work with students. I am one of six fifth-grade teachers. I usually have 23 to 25 Diné students in my classroom. My class is a mixture of general education, special education, and English Language Learner (ELs) students. The fifth-grade classes are self-contained for core subjects like the English Language Arts (reading, writing, vocabulary, and grammar), Mathematics, Science, and Social Studies. Intervention Reading and Elective classes are transition classes and our students move to other classrooms within the school building for these classes. Physical Education is the exception, the gym is located in a building next to the school. .

Teaching Objectives

I want my students to know how land connects living organisms and natural resources. These relationships are needed to keep all beings in balance. My fifth-grade students are at an age where they can comprehend the interconnections of the living earth. I want my students to know more about how climate change affects Betatakin Canyon. Most of our students do not know much about climate change and its effects on land and plant life. Additionally, during the last fifteen months they have spent the majority of their time at home because of the Covid-19 pandemic. They have participated in Zoom and Google classroom to meet their educational

needs. However, not all students actively participated in their online learning. Some students logged onto Zoom and did not participate. Only three percent of my students actively participated during the entire school day. Because of this many of the students have had learning losses during the 2020-2021 school year. Students also faced the additional hardship in getting their computers to work from home. Some of their homes lack electricity which is an essential component for students connecting with the school's internet hotspot. In some cases, hotspot devices were useless because the students lived in areas where there were no towers. Some students were able to find a way to solve their internet issues. One of the solutions was for parents to drive into Kayenta and park at the school parking lot in order to access the school's internet so that their child could attend class.

Students had other challenges apart from accessing the internet from their homes. The pandemic itself was a major factor that affected students' education. Some students had family members infected by Covid-19. Some of these family members were hospitalized and some died. Covid-19 has directly affected many of my student's lives--especially those who have lost a parent, grandparent, aunt or uncle, or even a sibling. Some students caught Covid-19 and had to focus on getting better while also trying to complete school assignments. Understandably, these students had a hard time concentrating on schoolwork while Covid-19 attacked their immediate families.

As teachers, we need to do our best to help our students adjust and move forward with their lives and we can use nature as a positive, healing element. Schools can support teachers by providing counselors and coaches with materials to help students. But teachers can best assist these traumatized students because they are with them for the majority of the teaching day. Teachers will need to know how to console students and passionately teach them engaging topics that hook their interest and help them concentrate.

Utilizing various classroom strategies and activities will assist students in comprehending the content and engaging with topics. Strategies and activities like scaffolding, frontloading information, pictorial visuals, repetitive phrases, chunking information, color-coding, songs, rap, and chants will help students stay focused and engaged. In addition, using these classroom approaches will help the student absorb the content while gaining skills in reading, writing, and vocabulary. These strategies are developed by the Guided Language Acquisition Design Model (GLAD). GLAD strategies help teachers use colorful graphic organizers with deep, engaging topics to teach visual information displayed in charts.

Why I Chose to Teach about Betatakin Canyon

My curriculum unit is about Betatakin Canyon, located on the Shonto Plateau. I want my students to know the importance and uniqueness of the canyon's fauna and flora. Each aspect of the canyon has different variations of plant and animal species and I hope to help students appreciate how the canyon is unique. I also want to teach them some of the geology of Betatakin Canyon. For instance, during the Triassic era, the area was a large bowl-shaped landscape where water seeped in. Eventually, the whole area became a vast lake. The land slowly changed as substantial dunes formed layers of different sedimentary rocks and geologic uplifts of plateaus and monoliths continued into the Jurassic era (Rothman, 1991, p. 8).

Part of the canyon's uniqueness is that it was the last canyon to be discovered by the geologists, Brotherson and Fairchild. The other canyons like Keet Steel, Inscription House, Tsegi, and Nistin were excavated for pottery and other artifacts the Anasazi left behind. The Navajos called Betatakin Canyon *beetaat' akin* which means hillside house. Today it is known as Betatakin National Monument. This unique place is 30 miles southwest from Kayenta and our students need to see that they don't have to go far to see remarkable things, there is an extraordinary canyon with interesting land formations and plants in their own backyard.

Content Objective

The Colorado and Shonto Plateau

The Colorado Plateau encompasses parts of four states (Arizona, Colorado, New Mexico and Utah) and is located in what is generally known as the four-corner area. The 240,000 square mile plateau has many smaller plateaus and buttes, numerous winding and deep canyons, and snow capped mountains. The primary formations of the plateau are composed of sedimentary rocks like sandstone, limestone, and shale. The elevation ranges from 3,000 to 14,000 feet with an average of 5,200 feet (Foos, 1999). Foos, a geologist specializing in the Colorado Plateau, explains how geologists divide the plateau in sections,

> The Colorado Plateau has been divided into the following six sections. 1) Grand Canyon section, structurally this is the highest part of the Colorado Plateau province. 2) High Plateaus section, this section is characterized by high north-trending plateaus, separated from each other by faults. 3) Uinta Basin, this is structurally the lowest part of the Colorado Plateau. 4) Canyonlands section, deeply incised canyons are distinctive features of this section which contain large monoclines and laccolithic mountains. 5) Navajo section, this is an area of scarped plateaus that is less dissected than the Canyonlands section. 6) Detail section, this section is largely volcanic in origin (Foos, 1999, p. 1).

The significant faulting and folding of sedimentary rock from the Paleozoic era is exposed and we can see these rocks in Betatakin Canyon today. Approximately five million years ago, the Rocky Mountains and the entire Colorado Plateau were uplifted to about 4,000 to 6,000 feet. The young mountains began to form and were uplifted as plate tectonics shifted upwards. The tectonic processes defined the plateau margins that we can identify today. Existing fault shifting and movement caused the plateau uplifting which caused the northern part of the plateau to tilt north. When this movement happened, the streams and rivers began to cut into the sedimentary formations while other types of erosion (wind, weather, and heat) helped the water cut through the rock. Despite this process of significant uplift, the plateau has remained a solid plate (Foos 1999).

Shonto Plateau

The Navajo National Monument was established on March 20, 1909 when President Howard Taft signed into law proclamation 872. The local natives did not think of the area as becoming a national park. The Navajos who reside near the canyons do not go into the canyons because of

the Anasazi ruins. It is a common Navajo traditional belief that we should not go near the ruins in the canyons because the ruins and remains are of people who no longer exist. The canyons are comprised of three ancient cliff dwellings located on the Shonto Plateau. The cliff dwellings are located in Betatakin, Keet Seel, Inscription House, and Navajo Mountain canyons .

During the lower to middle Triassic period (about 225 million years ago), the portion of the Colorado Plateau that contains the Navajo National Monument was a vast basin into which the drainage from the surrounding highland flowed. Over millions of years, the shallow sea basin transformed into a desert. Massive windblown sand piled into the region forming vast dunes that eventually created huge sandstone layers about 300 to 500 feet high. About 245 millions years ago, at the beginning of the Jurassic era, a short wet climate created moisture in the region. As much as 1,000 feet deep in fossilized cross-bedded dunes, the Navajo sandstone was a primary feature of this time (Rothman, 1991).

Shonto Plateau Canyons

The canyons within the Shonto Plateau have unique topography. The primary geological formation of the Tsegi Canyons is the tall, sheer cliffs of Navajo sandstone. As Brotherson and Fairchild, two geologists who studied these canyons, describe:

> At the base of these cliffs in the canyon, tallus accumulations can be found while the canyon bottoms are filled with deep deposits of sand alluvium. In Keet Seel and Nitsin Canyons these alluvial deposits are deeply eroded (Brotherson & Fairchild, 1977).

Although these canyons have similar geographical formations, they also have unique differences. For example, the sedimentary differences at the bottom of the canyon have notable differences. The depth and width of the canyon floor and the limited plant and animal habitat contributes to the erosion of the canyon floor. The movement of people into the area also contributes to the amount of plant and animal life and erosion.

Along with the geological formation of the canyons, the flora is abundant above and below the canyon. Juniper-pine and mixed shrubs are found in all parts of the canyons along with other plants that thrive in semi-arid environments. The vegetation in the Betatakin Canyon area is highly distinct compared to the other canyons (Keet Seel, Inscription House, and Nistin). Betatakin Canyon's plant community has vegetation species associated with high mountains rather than desert habitats. The unique tree species in Betatakin are oak, pinyon-juniper shrub, pinyon-juniper sage, pinyon-juniper grass, Douglas fir, and aspen. These plant species thrive in the canyon because the area has good moisture consistency created by the geologic formation and sandstone hydrology on the canyon floor. Betatakin Canyon is the only place on the Shonto plateau where Douglas fir and aspen trees grow. These trees are able to grow here because of the short span of direct sunlight. The seeps emanating from the northern Navajo sandstone give favorable moisture to the trees. Other factors that contribute to Betatakin's unique vegetation in the canyon are consistent moisture, location of the trees, and the fact that the canyon was discovered long after the other canyons were more eroded.

The richness of flora and fauna on the Shonto plateau gives life to the canyon floors. Other canyons, unlike Betatakin, were highly disturbed due to erosion and the heavy grazing of livestock. Local communities have allowed their livestock to constantly graze and this has resulted in a loss of (mostly perennial) vegetation. As a result, weedy, non-native species have invaded and have come to dominate the vegetation of the plateau.

The Effects of Climate Change on the Shonto Plateau

The relationship between overgrazing, vegetation change, climatic variability, and arroyo cutting and filling has been a central theme in many studies of the Southwest (Cambell, 1970). Since the late 1890s, studies on the changes to the land have been conducted because these changes have drastically damaged the original land vegetation and have caused significant erosion. Another problem is that the topography of the land has diverse patterns within the environment and each micro-area reacts to change in various degrees. The effects of these problems render generalization difficult and illustrate the need for detailed area studies based on as much environmental data as is available.

One of the difficulties in studying this region is that the Shonto Plateau is very remote and getting to particular places is difficult or impossible because of the lack of road access. Another issue is that at the beginning of the 20th Century, these studies were not concerned with conservation. Much of the data from the area is from the early 1900s, and the introduction of livestock around that time created a considerable imbalance. The grazing of animals has dramatically increased erosion and when it rains the land becomes prone to the creation of gullies. Another threat to the canyons is the practice of the Peabody Coal Company of transporting their coal slurry to the Mohave Power Plant. This has resulted in the sale of 3,000 acre-feet of groundwater each year to Peabody Coal Company. No water from the Colorado River was ever used in the slurry and this has had an impact on the water table in the vicinity of the Navajo Monument (Rothman, 1991). It has posed a problem for the monument because the people depend on well water that comes from the same aquifer Peabody Coal uses for their slurry. Peabody Coal has become a threat to the livelihood of the canyons. Peabody Coal Mine, the Navajo Generating Station, and the Mohave Power Plant were closed down in 2019 and this should have positive effects on the environment.

In addition to overgrazing, erosion, and the lack of water, air quality has also posed a threat to the canyon. Between 1963 and 1980, the coal plant caused a significant decrease in visibility in the area, and pollutants attributed to it were detected as far as 200 miles away (Rothman, 1991). During certain weather conditions, a plume of smoke or streaks of smoke were visible at the monument. As the air around the canyons became less clear, advocates for environmental safety began to voice their concern about the damage it would cause within the canyon flora and ancient ruins. The passage of the Clean Air Act of 1970 was a significant step toward bringing the issue of the effects of air pollutants to the public's attention, but many found the law inadequate (Rothman, 1991). Managing the air quality on the Shonto Plateau is very difficult because of the way that air moves is effected by inversion into the canyons. The smog from the power plants contained sulfur dioxide, nitrate oxides, and black soot known as flying ash. The power plant emissions affected vegetation and archeological ruins because acid in the air can

cause acid rain. Today, the National Park system currently monitors the air quality within the national monuments.

Diné Culture and Language

Listed below are the characters in a play about climate change in the Betatakin canyon. The characters in the play have the following significance in Diné culture and traditions:

Raven: in Native American Culture, Zhi'ii have symbolic meaning. The bird is considered a trickster with changing attributes. Other cultures consider it as a scavenger or a bad omen. Zhi' ii or Gáagii which is a common name for large black birds.
Red Fox: found on the Navajo Reservation, Maii' iiltso (Navajo for "Red Fox") possess mystical healing power, and Navajo Medicine Men use them during winter ceremonies.
Coyote: social animals commonly seen in the Navajo Nation. Ma'ii are said to possess mystical powers. Coyotes are messengers who warn the Navajo people of events that will happen. The People respect the coyote because the animal is in our creation stories.
Bear: found on the Navajo Reservation within the Chuska Mountains. The Black Bear was given to one of the Navajo Clan – Kin yaa'nii (the Towering House Clan) as their guide and protector. The bear is our brother. They are bipedal and have five fingers and toes. The Diné people do not hunt or eat bears. We do not feed, touch, or laugh at bears. We also do not call out their name in Navajo.
Rabbit: gah, was the main staple food for the Navajo. Rabbit represents a time to hunt. The rabbit is known to combat hunger and famine. The rabbit that hops, Gah Hahat'e'ii, was placed in the southwestern horizon in the fall when the traditional hunting season began.
Storyteller: people who give oral history by passing on these stories by word of mouth from generation to generation. The stories they tell teach lessons, history, and help us remember where our traditions come from. Most of the stories are told in our Native language because when told in English, the meanings lose some of their value. Saad bee háne' are storytellers.
Three Elders: the three Elders are supportive female leaders in most Native American cultures. The Elders are leaders, medicine people, and herbalists. Elders are held in high respect and reverence in Native American communities. Elders provide wisdom and leadership to their people because of their spiritual and traditional knowledge. They are the pillars and heartbeats of their tribes. Their old age and great wisdom give them a cultural perspective and a deep understanding of God and nature. When an elder speaks, we stop and listen because an elder is known to have many important teachings and stories about the old ways. They say God often speaks through Sa' (elders).
Oak Tree: the Tsé ch'il (oak tree) has important uses within the Navajo and Hopi tribes. Scrub oak acorns were gathered for food and ornaments. Chopped oak is also used to keep the fire at a slow burn throughout the night so when morning comes the ashes can be used to rekindle the fire.
Aspen Tree: tsii'beii (aspen trees) are good for sheep and cattle foraging. The aspen tree grows at certain elevations in mountainous regions.
Juniper Tree: gad (juniper trees) have uses as food and medicine. When the berries ripen and turn purple they are mixed with venison, fat, and fruit berries like pemmican. The green scale-like foliage was used as medicine. When the foliage turned yellow, they were burnt to ash and were mixed with blue cornmeal to make blue corn mush.

Sage: ts'ah, sage is used for colds. The plant is boiled, the steam is inhaled and a small amount of the liquid is drunk to help with coughing and cold symptoms. It has a minty Vicks scent.

Teaching Strategies

As I teach my unit, I want my students to learn about our surrounding land formations, to know what is essential to the land and in our many canyons and particularly in the Betatakin Canyon because of its location and uniqueness.

The classroom strategies for my unit are from the Guided Language Acquisition Design (GLAD) model. The GLAD model uses white paper for the teacher-made chart, color markers for chunking information, and critical vocabulary. The additional strategies I will use which are integrated within the primary strategy are strategies like 10/2, Retell facts, Sketch & Write, The Important Thing, and others.

Pictorial Input Chart

I teach fifth-grade students and many of my Navajo students are visual learners. A pictorial input chart focuses on the strong oral language of content and vocabulary. Critical language skills are used in a visual format using colored markers while explaining the content and vocabulary. The visual format allows for increased comprehension of academic concepts. While explaining the details about Betatakin Canyon, I will use pictures to aid in understanding. The content of the canyon includes the plants and animals within the canyon, the formation of the canyon and why the canyon can sustain itself. Additional strategies that can used during the pictorial activity are the 10/2 (the practice where the teacher explains for ten minutes, then students retell what was learned for two minutes), left/right partner share, Sketch & Write, and vocabulary strip review.

The process of teaching the pictorial input chart is to review the vital content and vocabulary written on the chart. As I review the content, each picture/photo is placed onto a large chart to stress the importance of the topic. The pictorial is reviewed throughout the week and we focus on the content and vocabulary. Chants and songs are additional activities that are added to reinforce further learning about the topic.

Expert Group

Expert groups are pairings of three or four students in which each student becomes an expert on a particular topic. Each individual is given an expert paper on a topic (our topics will be on Betatakin, Tsegi, Keet Seel, Inscription House canyons) that includes text, boxes, and a mind map with categories.

Numbered heads is a strategy in which students are assigned a number one through four. This way the selection of the student expert will be randomly chosen. For example, all the number ones from each group will become experts in Betatakin canyon. The teacher and the expert group read the mind map categories. The mind map is an organizer that focuses on a specific topic from the unit content like a graphic web organizer. Then the teacher will use pictures to aid

comprehension and to identify the main ideas to connect with the process grid which is described in more detail below

The class will progress in the following way: first, the teacher and group will read one paragraph at a time, next the teacher will guide the class to highlight the main ideas in each paragraph For each highlight, students will sketch a picture that connects with the highlighted words. As the teacher and students progress through the paragraphs, the teacher will gradually give the students the responsibility to come up with the main ideas. Throughout the lesson, students will record their information onto their mind map. After their mind map is completed, students will retell their newly learned knowledge with the teacher. Finally, the teacher will explain to the students that they will share the expert information with their group as the expert person about the topic they have just learned.

Process Grid

The process grid is a chart that categorizes essential concepts from previously learned content, like the information that has been gathered by the expert groups. The grid is organized with the facts at the top and the topics listed down the side. For example, the grid side could have the names of the canyons and the top of the grid could have categories like location, plants, animals, estimated date of discovery, water content, and uniqueness. The expert teams will confer with their group and decide what facts go in each column. The teacher will randomly call on individual students from the teams to share their answers. Additionally, students will be allowed to provide information from other charts (pictorial, narrative input charts, exploration charts, the Cognitive Content Dictionary, Chant/Song Chart, Sentence Pattern Chart, and Inquiry Chart) onto the process grid to complete the information.

Classroom Activities

To teach this three-week unit to my Navajo students, I will begin with an inquiry chart. An inquiry chart is a T-chart drawn on a chart paper with two columns. The teacher records two quotes in the form of questions from students in colored markers. Additional activities like Text & You (writing), Exploration Report (questioning), The Important Thing About (paragraph framing), and interactive journals will be assigned to students to attain a deeper knowledge and comprehensible input about the narrative input chart.

While guiding students with the expert groups, the teacher will use photos as visuals to aid in understanding. Picture file cards are photos of the unit that are used in small groups to sort and connect to specific topics, strategies, or activities. Picture file cards of the leaders, maps, events, and documents are realia for students to connect historical information to the topic. The teacher needs to create about fifty laminated photos because the picture file cards are helpful when reviewing other charts like the pictorial, narrative, chants & raps, exploration report, observation chart, expert groups, big books, and literacy awards.

After completing the process grid, students will write comparison and contrast paragraphs about the different canyons. The co-operative strip paragraph is an activity that uses sentence strips and pocket charts. The student teams will write a collaborative sentence using the information from

the process grid. All the sentence strips will be inserted into the pocket charts in a paragraph format, and then the teacher will edit the team's writing with the students by using an editing checklist. The students will be given numerous opportunities to reread and revise the paragraphs. After completing the paragraph as a team, students will begin another section using a team pocket chart and sentence strip.

Throughout the unit, I will review the canyons and the importance of the canyons within the Black Mesa region. Students need to know the importance and value in their surrounding area and how these canyons benefit life. Students can learn about what the canyon can provide in terms of education, history, climate change, and national parks.

Student Assessment Plan

Assessments are quick exit tickets, quizzes, or formal to summative tests.

Exit tickets	Quizzes	Formal tests	Summative tests
Four-corner	Fill-in-blanks	Questions, fill-in-the-blanks, vocabulary grid, short reading,	Questions, fill-in-the blanks, vocabulary grid, short reading,
Sketch & write	4-5 Questions		
Multiple Choice	Text & You		
2-3 Questions	Chant/Song		

Exit tickets are a formative assessment tool that allows teachers to assess how well students understand the lesson. I usually give exit tickets after the lesson so I can understand what the students have learned. I then use the data to adapt my instruction to meet my student's needs the following day.

A quiz is a quick informal assessment of what students know from the lesson. The quizzes I administer have five to ten multiple-choice, fill in the blanks, and short answer questions. I usually administer quizzes at the end of the week.

Formal and summative tests are given at the end of the unit. These tests are lengthy assessments with essays , multiple-choice, true/false, sketch and label, vocabulary questions, and completing a grid.

Alignment with Standards

My curriculum unit, The Upside Down Forest and Climate Change in the Betatakin Canyon, focuses on the canyon flora and fauna and makes connections with climate change. Diné and state standards are aligned to my curriculum content.

<u>Life Science Standards</u>

5.L3U1.10 Construct an explanation based on evidence that the changes in an environment can affect the development of the traits in a population of organisms. Students orally describe and write the changes in the environment in the Black Mesa Region and its canyons.

5.L4U3.11 Obtain, evaluate, and communicate evidence about how natural and human-caused changes to habitats or climate can impact populations. Students analyze, discuss, and conduct a written evaluation of natural and manufactured causes and changes of the canyon's fauna and flora.
5.L.4U3.12 Construct an argument based on evidence that inherited characteristics can be affected by behavior and environmental conditions. Students participate in a play about climate change within the Black Mesa region and the different canyons in the area.

4th-6th Diné Culture Standards
Concept 2- Nahat'á: Nahat'á' bits'áádoo anootíłígíí bih'ehgo ánísht'ée dooleeł. (I will apply and practice the Diné way of life through planning). PO 3 Niłch'i ał'aan ánáá'níłígíí baa hane' yíísínísts'áa'go shił béézhózin dooleeł. (I will listen to and retell stories related to elements of nature). Students participate in a play about the canyons and climate change.
Concept 4- Siihasin: Dinék'ehjí na'nitin siláhígíí bóhoosh'aahgo éí bee siih dinisdzin dooleeł. PO 2 Tó daholoogoo shil beehozin dooleel. (I will locate the different water sources). Students understand and learn the water process within each of the canyons. They will learn the importance of water and how water seeps into the canyons and provides water to various locations.

Resources

Gidley, Julie Blake. (2007). *Ponderosa Pete*. Ecological Restoration Institute, Northern Arizona University. The teacher will create a narrative input chart using the book for the students to listen to the story. Students will focus on the content and vocabulary words.

Patton, David R. (1998). Beyond the Ponderosa: Successful Landscape Trees or Higher Elevations in the Southwest, Flagstaff Community Tree Board. Students will use specific pages to research trees that grow within the Shonto Plateau region.

Flagstaff Arts and Leadership Academy is 2012-2013 Advanced Creative Writing. The Yellow Belly Ponderosa Project 2013. Students will read the play to understand how play script is formatted and know more about climate change.

Brotherson, Jack D. & Fairchild, John. (1977). Ecological Studies at Navajo National Monument Part 1 For National Park, Service Southwest Region and Navajo National Monument.

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Kayenta, Arizona Population 2021. (Demographics, Maps, Graphs). November 19, 2021 https://worldpopulationreview.com/us-cities/kayenta-az-population

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Rothman, Hal K. (1991). *Navajo National Monument: A Place and Its People. An Administrative Study*. Southwest Cultural Resource Center Professional Papers No. 40, Santa Fe, New Mexico.

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Working at Kayenta Unified School District / Glassdoor
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