Diné Institute for Navajo Educators

"Culture and Science: How Every Culture Contributes to Science"

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Diné Institute for Navajo Nation Educators

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Author Note:

R. Scott Godwin, Diné Institute Fellow, is a sixth-grade teacher at Mount Elden Middle School (MEMS), located in Flagstaff, Arizona. MEMS is part of the Flagstaff Unified School District #1.

The author wishes to acknowledge the incredible support and guidance given by the Diné Institute administration and staff, seminar leaders, and fellows in this cohort. The lessons and resources have opened up a larger picture of how each and every culture contributes to science. The stories told by presenters, staff, and members of the cohort gave strength to this author's desire to promote equity and respect to all cultures, especially the voices of the Indigenous people who have been silenced over the years.

The author also acknowledges the staff, students, and families of the MEMS community for participating in this curriculum unit. Through exploration of our stories, we create the hope for generations.

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“Culture and Science: How Every Culture Contributes to Science”

Topic and Content

“How can we see ourselves, our knowledge, …reflected in science…?”
- **Jaime Yazzie, Senior Research Coordinator, School of Forestry, Northern Arizona University (2025)**

This quote is the anchor statement for the framework of my science classroom and curriculum. It sets the stage for a place-based educational system that works hand-in-hand with a culturally responsive science classroom.

Unit 1: Welcome to Science!

This unit will provide an introduction to the required scientific knowledge, procedures, and skills needed to be successful in science 6. The Arizona Sixth 6 State Standards are created in order “to develop a scientific understanding of the natural world, students must be able to ask questions, gather information, reason about that information and connect it to scientific principles, theories, or models, and then effectively communicate their understanding and reasoning “(ADE, 2021.).

The curriculum unit includes lessons that introduce scientific vocabulary, data collection, research, and the scientific method. The lessons are essential for students to begin their journey into understanding why a scientific perspective and skill set is needed to be successful in this world.

This paper outlines the first six weeks of the curriculum unit and focuses primarily on the research project where each and every student will investigate their culture and cultural ancestral research. The purpose of this research project is twofold:

1. Each student will release that every culture in the world contributes to the development of science. Their culture, therefore, will be required as necessary and respected.
2. The research project will create a repository of knowledge to be used throughout the school year. This knowledge will be part of every unit taught: Unit 1: Welcome to Science!, Unit 2: Physical Science, Unit 3: Earth/Space Science, and Unit 4: Life Science”.

The plan is to use the repository to provide context into the lessons presented throughout the school year. This repository is intended to be organic and constantly revised as the students, and I explore the way science has provided possible answers to the way the Universe works. The explicit intention of the use of this repository is grant each and every student the opportunity to see that their culture matters, their place matters, and they matter.

This curriculum unit occurs in Quarter 1 of the school year. The unit sets the stage for the entire school year, incorporating the philosophy of inquiry for our Science class. Unit 1 includes the concepts of Inquiry, Culture and Science, Place-Based Learning, and the Scientific Method. These concepts create a safe learning environment that investigates the Universe using Western Knowledge and Traditional Ecological Knowledge, along with scientific procedures and skills.

Demographics: Who are the students for this Curriculum Unit?

The curriculum unit is designed for the sixth-grade students of Team Red 6 at Mount Elden Middle School (MEMS). MEMS is located in Flagstaff, Arizona and is part of the Colorado Plateau. Flagstaff is the county seat of Coconino County, the second largest county in the United States.

Flagstaff is a "border community", located at the southwestern border of the Navajo Nation. The students in the Flagstaff Unified School District #1 come from the towns in that southwestern region, notably Leupp and Bird Springs. Flagstaff is approximately 46 miles from Leupp. Flagstaff is a 74 mile drive from the Grand Canyon, which is a culturally significant landscape to many Indigenous tribes, notably the **Havasu'baaja** Havasupai Tribe – AZ, Hopi Tribe – AZ, **Hwal'bay** Hualapai Tribe – AZ, **Nungwu** Kaibab Band of Paiute Indians – AZ, Las Vegas Paiute Tribe – NV, Moapa Band of Paiute Indians – NV, **Diné** Navajo Nation – AZ, Paiute Indian Tribe of Utah – UT, San Juan Southern Paiute Tribe – AZ, **A:shiwi** The Pueblo of Zuni – NM, and **Yavap'e - Nn̲éé** Yavapai-Apache Nation – AZ (https://www.nps.gov/grca/learn/historyculture/associated-tribes.htm).

One-third of the MEMS student population is Hispanic. Flagstaff is approximately 340 miles from the Mexican border Many students cross the border with their families to live in Flagstaff. This demographic group also has their own indigenous history that contributes to this curriculum unit.

This central location is essential to understand the demographic make-up of the MEMS' student population. Mount Elden Middle School is approximately 1/3 Native American, 1/3 Hispanic, and 1/3 Caucasian and others. It is therefore essential that culture be explored in relation to the development of the students' scientific knowledge, procedures, and skills.

Any class at MEMS includes members from many of these cultural groups and therefore requires the curriculum to acknowledge the contributions that each culture has contributed to science. This first unit will provide the evidence needed to show that each and every culture has played a part in the development of science.

Rationale

As a Fellow with the DINÉ Institute, I have been introduced to the value and strength of Traditional Ecological Knowledge (TEK). I am a product of the American educational system that did not describe or give credence to this body of knowledge as I walked through my journey in education. This gap in my knowledge of the world and its people have left me, and countless others, deficient in the ways that science has been built from each and every culture on our Earth.

Figure 1

Figure 2

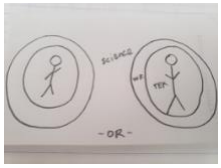

Figure 3

As our cohort explored, debated, and researched TEK, I struggled on how to present this incredible set of knowledge, skills, and practices into my classroom. I originally began with a Venn Diagram showing how Western Knowledge (WEK) and TEK compare and contrast with each other (Figure 1). The overlap allowed me to see where I could feel comfortable incorporating TEK and see where I would "be unable" to connect my WEK upbringing with TEK's importance in all scientific content.

The DINÉ Forestry cohort discussed this diagram and posited the thought that it may not be an accurate way of thinking of using WEK and TEK. We then moved onto a diagram of a person surrounded by concentric circles: the inner one being WEK and the outer one being TEK (Figure 2). In my ethnocentric view, a student in modern America would have WEK closer to them, and then enhance their learning through TEK. Further stories and testimonials from the cohort showed the inherent flaw in that thinking:

A more accurate realistic diagram emerged. Two people were shown surrounded by concentric circles. One person held WEK in the inner circle, while TEK was in the outer. The other person held TEK closer, while their outer circle contained WEK (Figure 3). It is this concept that shows that we must look and listen to the story of the person to see where they begin their scientific exploration.

Positionality Statement

The first step in this Curriculum Unit is to use the knowledge, skills, and practices given to me by this cohort to explore my own approach to science. I have spent the last several months looking at how I approach science, as well as looking critically at my history and practices as I grew up. My culture gave me many different views, some accurate and some not, on how people developed science. Having been raised in the Midwest during the 1970s-1980s, the traditional American version of science was the dominant lens. This version found its origins in the ending of the Cold War, where science was ripped from its cultural connections and any type of belief

system associated with science was seen as false and ridiculous. Even my own belief systems outside of "science" were seen as an incorrect way to explain how the Universe worked. Other cultures, especially Indigenous cultures, didn't stand a chance to be thought of as valid.

Thankfully, my students will have a different educational philosophy than I did. The Curriculum Unit will set the framework for my science class for the entire year. The unit puts WEK and TEK in the lesson planning process so that each and every student will see that their culture is vital to science.

In her lecture, Teaching Self-Efficacy Using Navajo Clans and Kinship Terms" (Irvin, 2025-present), Carolyn Irvin describes how creating goals that involve self-efficacy, a growth mindset, and creativity is essential for Native American students to establish emotional stability. Her experience as an educator has seen many examples of children who were seen as "lost" – mainly due to the exclusion of traditional Native American values and practices to their education. Ms. Irvin stated that "if they are lost, they struggle with Higher-Order Thinking" skills and abilities (Irvin, 2025-present).

A solution posed by the Institute for Native-serving Educators (INE) at NAU is the incorporation of Traditional Ecological Knowledge (TEK) and other aspects of Indigenous Science into the everyday educational units and lessons of science. The loss felt and seen by Ms. Irvin has been due to the systematic exclusion of this TEK and any piece of Indigenous Science in our American educational system. There have been exceptions of this exclusion, but nowhere but Alaska has there been a systematic approach to this incorporation. Alaska requires educators to incorporate TEK within all of the educators' plans and uses this incorporation in their evaluation of their educators.

This solution of incorporation guides this curriculum unit and my teaching style in my science classroom. The DINÉ Seminar project, along with the American Indian/Indigenous Teacher Education Conferences have helped to shape the framework of this curriculum unit and classroom environment. To understand more of this incorporation, a brief description of Western Science and TEK and Indigenous science is needed:

Western Science "often focuses on formal experiments, cataloging information, and publishing results in journals," (Ramos et al., 2020). Western Science is also known for its objective approach to experiencing phenomenon, disconnecting the individual or group from the Natural world. This is mainly done to attempt an objective approach to data collection, so that the human interests would not "taint" the data. Science, however, is a human tool that people use to try and understand the Universe. This denial of the human condition has brought about adverse decisions made by humans and allows corporations to manipulate data and research to serve their capitalistic needs.

Dr. Deepti Chatti in a 2022 TIF Talkies describes the role of humanity in their article "Climate Change and Traditional Knowledge Systems". The author details how the removal of local and community knowledge from the management of resources has led to the reduction of critical practices that have maintained the ecological balance. This reduction is affected by many factors, but ignoring the TEK leads to policies in land management that are "often mono- "in scope and

sequence (Chatti, 2022 - present). A more holistic approach is needed in order to regain balance in the world. TEK recognizes that "people as social/cultural beings" (Chatti, 2002) - present. The "everyday engagement with their environment" (Chatti, 2022 - present) has been at the heart of Indigenous Science.

Another detriment to adhering to the Western Scientific practices is that "Western science has often considered all new knowledge to be 'advances' without examining the impacts of what has often uncritically been considered progress," (Ramos et al., 2020).

Thankfully, organizations and individuals have presented a solution to filling in the gaps that Western Science has left us. "TEK can complement Western Science by providing local observations and historical information that can fill gaps in scientific data, improve scientific research, and facilitate environmental management and problem-solving…" (University of Colorado Boulder, 2024). The article goes on to describe that ultimately, TEK needs to be more than just filling he gaps, but it does give great strength to the argument on why using more than just Western Science to understand our Universe is so critical. Therefore, the curriculum unit will do just that.

My educational philosophy is as follows:

1. Science is a tool created by humans to explore and attempt to understand the Universe. This understanding increases humans' ability to solve problems and survive.
2. Science is not the only way/tool for humans to use to better understand the Universe.
3. Science can **and should** work with other ways/tools so that humans can have a better, and more complete, understanding of the Universe.
    a. Ex. STEM, STEAM, CRSTREAM
4. Since science is a human construct, science is interdependent upon all aspects of being human.
5. Science, therefore, respects the other aspects of being human AND engages in collaboration with these aspects in order to better understand the Universe, solve problems and survive.

This additional knowledge of TEK and how to integrate it with WEK has allowed me to redesign my teaching philosophy and styles. I am looking forward to implementing these new scientific skills to better serve all of my students. A guiding thought for my future teaching endeavors is: "We [educators] must more rigorously engage in evidence-informed decision making in what we teach and how we teach – not rest on normative routines," (Bang et al., 2020).

It is with all respect and gratitude to the DINÉ Fellowship, INE, and all their presenters that I move forward to educate myself and others on the power of incorporating Western Knowledge with Traditional Ecological Knowledge.

I wish to thank all of the people who have dedicated their time, knowledge, and passion towards the education of our students. It is the hope that each and every person on this planet realize that their culture contributes to science, and the world.

Rationale for the Curriculum Unit

At this time, fifth-grade students from the Flagstaff Unified School District do not receive a consistent education of science before they attend middle school. When these students arrive to either of the two middle schools, they receive a schedule where they attend a science class five days a week. A goal of sixth grade science is to provide an equitable experience in the science class so that all may gain the scientific knowledge and scientific skills needed to be successful in science.

I start the school year with Unit 1: Welcome to Science! This unit is critical since it sets the framework for our science class. Scientific vocabulary, procedures, and skills are introduced to each and every student in our sixth-grade team. Students will discover that science is a human tool and they will explore how science has been developed in the past, what humans are using science today, and what potential science can give humans in the future.

Students will write on the front of their Science 6 Journal the following three questions:

1. Who am I?
2. Where am I from?
3. Where am I going?

(Irvin C., 2025 - present)

Unit 1: Welcome to Science! contains essential lessons where students will research and describe how their culture has contributed to science. The skills and knowledge gained through the Quarter One lessons will promote scientific thought and identity, especially when TEK and WEK is woven throughout the school year.

This curriculum unit asks these essential questions, “What is my cultural identity and how has my culture contributed to science?” Students will interview their family members, research their cultural ancestral research, and investigate what significant persons and scientific concepts have been essential to the development of science.

The students' research will be presented to their classmates. A bulletin board with a map of the world will be displayed throughout the school year, emphasizing the scientific persons and concepts that the different cultures have furthered science.

A more contemporary version of the physical map will be used through the Google Earth app. MEMS students are each issued an iPad and will be able to navigate the Google Earth app to create a digital record of the students' cultures and scientific contributions.

The research will also be utilized throughout the entire school year. This repository of information will be connected with new concepts, procedures, and skills to help students realize how much science depends on all cultures.

The Arizona Science 6 State Standards provide the academic structure for this unit. The Arizona Science Standards includes three "universal" standards, labelled "Core Ideas for Using Science." These three standards outline the basic ideas for every grade level on how to use science in everyday life and in specific scientific research or engineering projects.

This lesson focuses upon the Arizona Science Standard U3: "Applications of science often have both positive and negative ethical, social, economic, and/or political implications," (ADE, 2021). The prominent way of teaching science has been exclusively focusing upon the tenets of Western Science (WS). This has left out entire cultures' body of knowledge. As the world is seeing tremendous changes in the climate, space exploration, and engineering, the reliance upon only one view, Western Science, is proving to be slowing down our ability to deal with our problems.

The initial focus upon the Arizona State Standards U1, U2, and U3 (Core Ideas For Using Science) allow each and every student to begin their journey towards data-driven problem solving.

Utilizing the Core Ideas for Using Science principles found in the Arizona Science Standards will provide the framework for this curriculum unit. Each and every student will be given the opportunity to develop the needed scientific skills and knowledge base, as well as research their culture to see how their culture has contributed to the required scientific skills and knowledge base. One main objective of this curriculum unit is to combat the traditional science instruction that uses the Western Science model to tell students how science should be.

The Western Science model is rooted in the mentality of America in the 1950s, where science was forced to be seen as cold and objective. This push removed any mention of a belief system outside of "pure science." In fact, scientists who suggested any word that included belief systems were seen as "kooky" or "pseudoscientists."

This mentality removed a key aspect of science – simply stated in the Next Generation Science Standards (NGSS) Matrix of the Nature of Science: "Scientific knowledge is a result of human endeavor, imagination, and creativity," (NSTA, 2013). This recognition as a human tool requires the acknowledgment of every part of a human to develop science.

NGSS goes on to state the obvious, but unrecognized concept in traditional American science instruction that, “Men and women from different social, cultural, and ethnic backgrounds work as scientists and engineers,” (NSTA, 2013).

While the Arizona Department of Education did not adopt the NGSS Principles, the department did create the Arizona Science State Standards that reflect these ideas in their own way. The following section outlines the standards:

“U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.

U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.

U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications” (ADE, 2021).

These Arizona Science Standards focus upon:

- **Science uses the technology and beliefs of that time period to explain phenomenon.**
- **Technology and beliefs can change over time.**
- **The ethical and social components of the human beliefs are important to the development of new scientific ideas and explanations.**
- **Science is used to develop solutions and explanations as further investigations as conducted.**

These standards form the Arizona Department of Education acknowledge that every aspect of humanity is crucial for the development of science: Therefore, the required Arizona Standards for the curriculum unit support the need for including TEK so that students can incorporate their own cultural knowledge and skills to explore science. Unit 1: What is Science! will use these standards to explore how students can connect their culture with science.

This unit allows the student to make relevant connections to your students’ cultures, families, communities, and histories through this research project. The importance of connecting the student and their families to science will be a critical part of maintaining high levels of student engagement and academic progress throughout the year.

Student engagement is described as:

> “…the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation that they have and progress in their education,” (edglossary.org, 2016).

Cheryl Alba and Brittany R. Fraumeni from McRel International define student engagement as "A condition of emotional, social, and intellectual readiness to learn characterized by curiosity, participation, and the drive to learn more," (Alba and Fraumeni, 2019).

Through the study of a student's culture, it is hopeful that the level of student engagement remains throughout the lesson, and ultimately, throughout the school year. As students see themselves in the process of scientific endeavors, they can come to understand that their culture and their personal identity contributes to science.

The overarching goal of this lesson is to show how each and every student belongs to a culture that contributed to the scientific body of knowledge. Students often ask: "When will I use this?" and it is another goal of this lesson to show how scientific knowledge and/or skills can be seen throughout their life.

Science is enhanced and furthered by every culture on this planet. Unit 1: What is Science! is the foundation for all other units for the Science 6 classroom and curriculum.

Teaching Plan

Unit 1: Welcome to Science!

This teaching plan outlines the content, timeline, activities, and assessments for Unit 1: Welcome to Science!

a. Topics/Subject Matter: Unit 1 Welcome to Science!
    i. Scientific Method
    ii. Culture and Science
    iii. Data Collection
b. Arizona Science 6 Standards: U1/U2/U3
c. Grade: 6
d. Learning Objectives/Alignment to Standards-
    i. Alignment with Standards – Unit 1 Welcome to Science! Introduces each and every student to the foundational principles of Science: U1/U2/U3

Core Ideas for Using Science	
U1: Scientists explain phenomena using evidence obtained from observations and or scientific investigations. Evidence may lead to developing models and or theories to make sense of phenomena. As new evidence is discovered, models and theories can be revised.	**Science's purpose is to find the cause or causes of phenomena in the natural world.** Science is a search to explain and understand phenomena in the natural world. There is no single scientific method for doing this; the diversity of natural phenomena requires a diversity of methods and instruments to generate and test scientific explanations. 2 (p. 30) **Scientific explanations, theories, and models are those that best fit the evidence available at a particular time.** A scientific theory or model representing relationships between variables of a natural phenomenon must fit the observations available at the time and lead to predictions that can be tested. Any theory or model is provisional and subject to revision in the light of new data even though it may have led to predictions in accord with data in the past. 2 (31)
U2: The knowledge produced by science is used in engineering and technologies to solve problems and/or create products.	The use of scientific ideas in engineering and technologies has made considerable changes in many aspects of human activity. Advances in technologies enable further scientific activity; in turn, this increases understanding of the natural world. In some areas of human activity technology is ahead of scientific ideas, but in others scientific ideas precede technology. 2 (p. 32)
U3: Applications of science often have both positive and negative ethical, social, economic, and/or political implications.	The use of scientific knowledge in technologies makes many innovations possible. Whether particular applications of science are desirable is a matter that cannot be addressed using scientific knowledge alone. Ethical and moral judgments may be needed, based on such considerations as personal beliefs, justice or equity, human safety, and impacts on people and the environment. 2 (p. 33)

Table I (www.azed.gov)

a. Diné standards (DINÉ):
   4th – 6th Diné Culture Standards
   Standard: I will develop an understanding of Diné way of life.
   Concept 1: I will acknowledge and value my thoughts and personality.
   PO 1: I will develop my cultural knowledge to build self-worth.

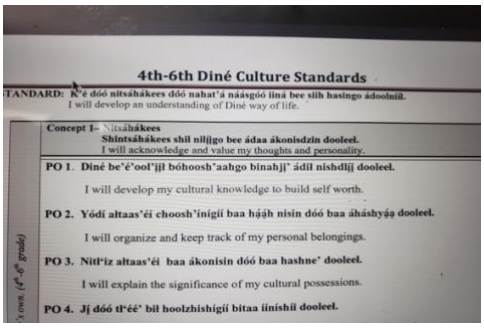

Table II: https://oscad.navajo-nsn.gov

CRAIS Tool principles

This lesson will attempt to score high on the Culturally Responsive Assessment of Indigenous Schooling (CRAIS) Tool. This tool is used "to provide a resource for educators and researchers to assess the degree to which the core principles of culturally responsive schooling are present in schools serving high numbers of Indigenous students" (Castagno, A. E. et al., 2025).

CRAIS scores the degree of cultural responsiveness that a school, teacher, and/or lesson is implementing. The sores range from 3 "High" to (-3) "High degree of opposite", allowing for an excellent range of assessment of the school, teacher, and/or lesson. The three main principles addressed by this lesson are:

- 2. Indigenous people are represented as contemporary (not only historical).
- 4. Traditional and/or cultural knowledge is included.
- 14. Encourages students to understand themselves within broader communities. (Castagno, A. E. et al., 2025).

This lesson introduces the concept of Traditional Ecological Knowledge (TEK) and aspects of Indigenous Science. In the lesson, students ask family members about their cultural heritage, especially in regards to their cultural ancestral research. Students ask a series of questions to family members in order to determine which country(ies) of origin describe where they come from. This information will be used to complete a research project in the first quarter.

This information will be used for three purposes:

- The completion of a research project for the First Quarter
- The creation of a repository of knowledge that we used throughout the 2025/2026 School Year.
- The continuation of the use of cultural language, in lessons and student work, to describe scientific concepts and vocabulary.

The result has been shown to work. In the blog post "Creating Science Learning Environments Which Indigenous Students Can Thrive, the authors detail the effect that incorporating the Indigenous language and exploring their culture brings forth new discoveries and knowledge that would not have been made possible to every student if the normative teaching styles were kept. T "We have engaged young people in investigations in which they wonder, ask questions, and investigate their lands' socio-ecological histories, and explain how and why ecosystems have changed over time and how they might change again" (Bang et al., 2020).

Sequence of instruction used to deliver content and facilitate learning

Week One: 8.4.25 – 8.8.25 "How Do You Gather Knowledge?"

Lesson 1: Science Delivered! By Collaboration between: Dr. Seafha Ramos, Cherie Paul, and Maximiliano Quezada.

https://static1.squarespace.com/static/5d092cd8f0025600012387be/t/6035f176191e28316a25de57/1614147958671/Lesson+1+Teacher%27s+Guide%2C+How+Do+You+Acquire+Knowledge.pdf

Students are introduced to the inquiry aspect of science with this lesson. A major goal is to provide a safe learning environment for each and every student. Students will be given an opportunity to express their ways of gathering knowledge in multiple ways. Students could speak their understanding or a written response is totally valid. Any response will be helpful in furthering the discussion.

Another major goal is to establish one of the most important skills in science: observation through the five major senses of the human body. The lesson will include brief notes and discussion on how humans use their senses to comprehend the Universe.

As an assignment, students will learn that they do not need to speak in the group in order to be successful in their grade. A discussion on how to earn their grade will become an important wrap up of this lesson.

Different prompts will be given throughout the week – visual, audio, etc. Students will be trained in creating responses to show how they are gathering knowledge. Students will be encouraged to describe other times they have gathered knowledge. These other times could lead to new ways to gather knowledge, so that any student could benefit from this experience.

**This week also includes the orientation of all students at Mount Elden Middle School (MEMS), especially for sixth graders as this is their first time at MEMS.

Assessment: Student written responses to the prompt: "How Do You Gather Knowledge"

Week Two: 8.11.25 – 8.15.25. "What Is Data?"

This week explores the nature of data, the different types of data, and how data is often expressed in Science. The first lessons build on how students gather knowledge and then attempt to categorize the knowledge as data.

Data primarily is shown as quantitative or qualitative. Students will be given various forms of data and place them into the two main categories. Students will also be given phenomena to

observe and then gather knowledge in their favorite way. The students will attempt to place that knowledge into the two main categories.

Students will be given more prompts and phenomena to practice their observation skills throughout the week.

Students are will be introduced to basic graphs and charts to show how scientists display data. This sets the stage for the remainder of the year's practice with graphs, charts, and other ways to display data.

Assessment: Paper Quiz #1A: "What is Data?"

Week Three: 8.18.25 – 8.22.25. "Maps and Legends"

This week introduces the students to MEMS' Outdoor Classroom. Students will go to several places on the MEMS Campus to learn about basic orientation and compass work. Students will use a class set of compasses to learn the directions in relation to their MEMS Science Classroom and the locations outside.

This week also is supported by the collaboration of MEMS with the City of Flagstaff PROSE (Parks, Recreation, Open Spaces, and Events) and Willow Bend Environmental Educational Center. The lessons introduce the Science 6 Journal. The students learn about the basics of nature journaling, as well as the concept of phenology. Students will choose a particular place to record their observations in their journal and record them. This place becomes very important since they will return to this particular place throughout the school year in order to observe changes to their place over time.

Students will also be introduced to watercolor as a means to observe and enjoy nature. Students will take their initial journal observations and learn to use watercolor to explore their observations in a deeper way.

Assessment: Student-drawn/detailed map of MEMS with Compass Rose

Week Four: 8.25.25 – 8.29.25. "Culture and Science, Part One"

This is the first research project for the school year. Students will research their family history to get information on their culture and their cultural ancestral research. Students will use this information to complete a Google Slide Show that will highlight their knowledge if it is appropriate to share in public.

Students will be given a Google Slide Show that details what should be included on each slide. Time is scheduled for every class to work on the slide so that each student knows exactly what is expected. A rubric will be handed out and discussed so that each and every student understands

the expectation of the research project. An additional week of time and assistance will be provided during Week Six (9.8.25 – 9.12.25).

Assessment: Checklist of tasks done for Research Project, Part One

Week Five: 9.1.25 – 9.5.25 "Scientific Method: How Do I Get Ready for Camp Colton?"

Students will be introduced to the Scientific Method by preparing for Camp Colton. The Essential Question posed is: "How will I enjoy Camp Colton?"

One goal for the week is to hand out the Camp Colton Packing List and discuss what the students will need to do in order to prepare them for their stay at camp. The discussion will be supported by introducing the Scientific Method by having students walk through the steps of the Scientific Method in order to solve a "problem": enjoy Camp Colton. Camp is a wonderful experience, although many students have little to no knowledge of how to participate in camp.

The "problem" is to be approached through research, observation, discussion, and group work. Students will research the Hart Prairie region of the San Francisco Peaks, located approximately 35 minutes from MEMS. Maps, videos, stories, and other media will be used to describe how the Packing List is a reliable tool for enjoying Camp Colton.

Assessment: Google Quiz #2A: "Scientific Method: Camp Colton"

Week Six: 9.8.25 – 9.12.25 "Culture and Science, Part Two"

This week has two goals:

- Additional time and support for the Google Slide Show.
- Additional time and support to prepare for Camp Colton.

Assessment: Final Draft of Research Project (Google Slide Show)

Teaching Strategies

As students participate in this curriculum unit, they will be able to experience the ethical space and see that each and every student's culture is to be respected and holds relevance to their life. I will explicitly create and maintain an "ethical space" as one of the foundation of my classroom. In the article, "Traditional Ecological Knowledge Engaging with Indigenous Peoples in Braiding TEK and Western Science." University of Colorado Boulder, 2024), the authors detail an environment of learning that allows all voices to be recognized and heard.

This approach grants equal opportunity for all participants to be respectfully listened to, so that their ideas can be discussed and debated without fear of shame or harsh stereotypes. This space combats the age-old discrimination of cultural practices that has been the rule, rather than the exception.

The "ethical space" is defined by the authors as:

> "An ethical space is where two different knowledge systems can come together in a place between both cultures in order to understand and communicate with one another, bringing their best intentions, practices, and knowledges together." (University of Colorado Boulder, 2024).

Using an ethical space framework can support the "reconciliation of Indigenous and Western worldviews with the goal of helping to co-create a better future together." (University of Colorado Boulder, 2024)

Furthermore, an ethical space framework requires all parties involved to consider the essential values of respect, relevance, reciprocity, and relationality at every step. "Ethical Space can serve as an effective, equitable, and harmonious approach to making complex decisions in the realm of environmental and climate justice." (University of Colorado Boulder, 2024)

In her presentation to the INE Residency in June, 2025, author and filmmaker Ramona Emerson led a writing workshop for the2025 INE Summer Residency. The powerful presentation led the INE Fellows to understand the importance of Native students recognizing that the students' stories and lives matter. She detailed her history in life and academia and stressed how Native students need to have role models from their culture in order to meet their academic goals and dreams. As Emerson wonderfully states: "They can't be it, if they can't see it" (Emerson, 2025-present).

Other teaching strategies include, but are not limited to:

- Partner Work
- Nature Journaling
- Classroom Discussions
- Exit Tickets (Formative Assessments)
- Drawing Your Understanding Using Storyboards
- Guided Notes

Appendices - Learning Resources

Map: Colorado Plateau

Figure 1. The Colorado Plateau Province. *Source: The National Geographic Society.*

What states are part of the Colorado Plateau?

List three cities that are found in the Colorado Plateau:

Culture and Science Family Research Worksheet

Name: **Per:**

Directions: Write your name in the center circle. Write down your family name(s) and describe what it stands for.

Family Name(s):

After you are finished with the family research questions, draw one picture for each piece of the circle (example: draw a pack of playing cards by the word "Games").

SOURCE: Google Slides

YOUR FAMILY – Research Questions

Directions: Ask your family the following questions. Write down your answers You can also draw a picture to help describe your answers!

Family Name

What does your family name mean? Does it describe your clan or where you are from or is there some other reason?

Games

What games do you remember playing with your family?

Are there any favorite games you play now with your family?

Food

Is there a favorite food that your family loves?

Are there any foods that your family makes for special occasions?

Water

How does your family use water? (examples: gardening, swimming, haul water to your house)

Are there any special places for your family to visit that involve water?

Technology

What kinds of technology are important to your family?

REMEMBER: Technology is not just digital. Tools and toys are also types of tech.

YOUR CULTURE – Research Questions

Directions: Ask your family the following questions about <u>your culture</u>. Write down your answers You can also draw a picture to help describe your answers!

<u>Ancestors' Location</u>

Where in the world do your ancestors come from?

What games do you remember playing with your family?

Are there any favorite games you play now with your family?

<u>Food</u>

Is there a favorite food that your family loves?

Are there any foods that your family makes for special occasions?

<u>Water</u>

How does your family use water? (examples: gardening, swimming, haul water to your house)

Are there any special places for your family to visit that involve water?

<u>Technology</u>

What kinds of technology are important to your family?

REMEMBER: Technology is not just digital. Tools and toys are also types of tech.

https://docs.google.com/document/d/1b3kDkw8yY8S4cwMFx78ZYGDvnCOFM3uz/copy?usp=sharing&ouid=102283453315766857837&rtpof=true&sd=true

Culture and Science Research Project

Your Name:

08.XX.2025

6TH GRADE SCIENCE

"How can we see ourselves, our knowledge, ...

reflected in Science?"

- Jaime Yazzie

Directions: Use your iPad to research the following questions. You should add an image next to your answer. Answer the following questions and attach an image next to it. This will help you when you create your Google Slides.

Use the family questionnaire to answer the following questions. Add an image next to your answer. This will help you when you create your Google Slides.

Remember to add the site and/or person you interviewed to show where you found your information (SOURCE:).

QUESTIONS:

ADD YOUR SOURCE	Your answer	Image
Where do your ancestors come from? SOURCE:		
Where is this place located on the planet Earth? SOURCE:		
Noteworthy Scientists: SOURCE:		

Noteworthy Inventions/Practices: (Hint: microscope, farming, etc.) SOURCE:		
Noteworthy Places/Locations: (Hint: Observatories, research labs, waterfalls, etc.) SOURCE:		

CULTURE QUESTIONS:

ADD YOUR SOURCE	Your answer	Image
Languages SOURCE:		
Celebrations		

SOURCE:		
Sports SOURCE:		
Music SOURCE:		
Food and Drink SOURCE:		
Food and Drink SOURCE:		
What does your last name mean? SOURCE:		
Do you have a clan name? Do you have a tribal name? SOURCE:		

https://docs.google.com/document/d/1evHMUsmSXVxMTXUS2pPs1X1p0PU6aMTfZQdnvz4SQew/copy?usp=sharing

My Culture and Science

Your Name
Class Period
Quarter One

The entire Google Slide Show is found at:

https://docs.google.com/presentation/d/1b_-HpKRiLBIjlSFfcb6EJY1dYQEo0I9cCuMsZlPvCPs/copy?usp=drive_link

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