"Design, Build, and Animate: Culturally Crafting the Future Through Science and Technology"

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Topic and Context

In today's digital era, technology plays an integral role in shaping the way students engage with scientific concepts. *Robotics, animation, and immersive learning platforms like Minecraft Education* offer dynamic opportunities for students to develop critical thinking, problem-solving skills, and creativity. This curriculum unit is designed to *bridge STEM education with interactive, hands-on experiences***,** ensuring that students not only understand scientific theories but also apply them in real-world contexts.

The integration of robotics and animation in science education fosters a deeper engagement with core principles such as physics, engineering, and coding. By using Minecraft Education, students can construct models that simulate scientific concepts, experiment with cause and effect, and develop a foundational understanding of computational thinking. The curriculum will encourage collaboration, exploration, and innovation**,** preparing students for the technological advancements of the future.

The modern educational landscape demands a shift from traditional passive learning methods to active, experiential approaches that mirror the collaborative nature of contemporary scientific research. Students today are digital natives who intuitively understand interactive interfaces and expect learning experiences that match their technological fluency. This curriculum recognizes that effective STEM education must leverage these natural inclinations while introducing rigorous scientific methodology through accessible, engaging platforms.

Robotics education serves as a cornerstone of this integrated approach, providing students with tangible connections between theoretical concepts and practical applications. When students program a robot to navigate obstacles, they simultaneously engage with principles of physics, mathematics, and computer science. This multi-disciplinary exposure helps learners understand how scientific fields interconnect in real-world problem-solving scenarios, breaking down the artificial silos that often characterize traditional subject-based education.

Animation technology offers another powerful vehicle for scientific exploration, enabling students to visualize complex processes that would otherwise remain abstract. Through animation projects, learners can model molecular interactions, demonstrate geological processes, or illustrate biological systems in ways that static textbooks cannot achieve. This visual approach particularly benefits diverse learning styles and helps students who struggle with traditional text-based instruction to access scientific concepts through alternative pathways.

Minecraft Education emerges as an exceptional platform for STEM learning because it combines the familiar gaming environment that students love with sophisticated tools for scientific modeling and experimentation. Within this virtual world, students can build scale models of atomic structures, design sustainable cities, or create complex machines that demonstrate engineering principles. The platform's collaborative features also mirror the teamwork essential in professional scientific environments, teaching students to share ideas, divide responsibilities, and integrate diverse perspectives into unified solutions.

The emphasis on hands-on experiences throughout this curriculum reflects current understanding of how deep learning occurs. Rather than memorizing facts for standardized assessments, students engage in authentic problem-solving that requires them to apply scientific principles in novel situations. This approach develops the kind of flexible thinking and creative problem-solving skills that characterize successful scientists, engineers, and innovators across all technological fields.

Collaborative learning forms another essential component of this curriculum design, recognizing that modern scientific breakthroughs increasingly result from interdisciplinary teams working together. Students learn to communicate complex ideas clearly, listen to alternative perspectives, and synthesize different approaches into innovative solutions. These communication and collaboration skills prove invaluable not only in scientific careers but across all professional contexts in our interconnected global economy.

The curriculum's focus on computational thinking prepares students for a future where data analysis, algorithmic reasoning, and digital literacy form the foundation of most career paths. Through robotics programming, animation creation, and Minecraft construction projects, students develop logical reasoning skills and learn to break complex problems into manageable components. This computational approach to problem-solving transfers readily to disciplines beyond computer science, including biology, chemistry, physics, and environmental science.

Finally, this integrated approach to STEM education recognizes that today's students will enter careers that may not yet exist, working with technologies still in development. By focusing on fundamental problem-solving processes, collaborative skills, and adaptable thinking rather than memorization of static information, the curriculum prepares learners for lifelong learning and professional flexibility. The combination of robotics, animation, and immersive platforms creates an educational environment that not only teaches current scientific knowledge but also cultivates the innovative mindset necessary for addressing tomorrow's challenges.

Rationale

The Community

San Carlos Community is a place where about 4,000 people live in Gila County, Arizona. It is part of the San Carlos Apache Indian Reservation, a vast area of over 1.8 million acres of land in the southeast of Arizona. San Carlos Community is the main hub and administrative center for the reservation.

San Carlos Community is a census-designated place in Arizona that is located within the San Carlos Apache Indian Reservation. Despite the oppression and violence they faced, the Apache people resisted and fought for their freedom and rights. They also preserved and developed their culture and identity through various forms of expression and organization.

Today, the San Carlos Apache Tribe is a sovereign and progressive nation that provides for its members and honors its heritage. The San Carlos Community is a place of pride and hope for the Apache people.

School Demographic

San Carlos Middle School aims to provide a quality education for its students that respects their cultural heritage and prepares them for future success. The school's mission states: "San Carlos Middle School will provide an environment that fosters academic excellence, cultural awareness, and social responsibility for all students." The school's vision statement states, "San Carlos Middle School will empower students to become lifelong learners who are respectful, responsible, and productive citizens."

I serve as a Science/STEM teacher at San Carlos Middle School, a public school in San Carlos, Arizona. The school belongs to the San Carlos Unified School District, which educates the students of the San Carlos Apache Indian Reservation. The school serves about 378 students from grades 6 to 8 and provides a curriculum that covers language arts, math, science, social studies, writing, and elective subjects. The school also features a library, a cafeteria, a gymnasium, and a computer lab, and by 2025 the school will open a new science laboratory room. The *Brave* is the school's mascot, and its colors are red and white.

San Carlos Middle School offers various programs and activities for its students, such as athletics, clubs, field trips, dances, and ceremonies. The school organizes field trips to places such as Point of Pines Lake, Phoenix Zoo, Arizona Science Center, and Grand Canyon University, and even out-of-state activities.

San Carlos Community is a place in Arizona that is located within the San Carlos Apache Indian Reservation. The community and the reservation have a history of living in interconnectedness, like many indigenous cultures, emphasizing the idea that everything in the universe is related. This is similar to the concept of entanglement in quantum physics and technology, where particles remain connected over vast distances.

The knowledge of ecosystems, the people, and the science behind the culture and traditions among the San Carlos Community may vary depending on their education, experience, and interests.

The School

The students at San Carlos Middle School, which serves the San Carlos Apache Indian Reservation, may learn about technology and integrate the lessons across the curriculum. The school also offers various STEM activities that enhance their learning and skills, such as engineering projects, arts and crafts (STEAM activities), and project-based learning approaches. San Carlos Middle School participated in the Regional Science Fair and Arizona State Science Fair competitions. These activities enhance the student's ability to hone the scientific processes and inquiry-based learning among our students.

Science Activities

The school also participates in the Regional and State Science Fair, which are open to all students in grades 5-8. The science fair allows students to conduct experiments, investigations, or demonstrations on topics of their interest and present their findings to judges and peers. This encourages students to apply the scientific method, use critical thinking, and communicate effectively.

The school participated and won various categories at the Regional and State Science Fair, which is open to all students in grades 6-8.

Science Curriculum

Our school offers a curriculum that includes science, technology, engineering, and math (STEM) subjects for its students in grades 6-8 aligned to the Arizona State Standards. The school also provides various opportunities for its students to engage in STEM activities that enhance their learning and skills. Among the many STEM activities in which the students in San Carlos Middle School participate are

Science Competitions

Robotics

The school has a robotics club that meets after school and teaches students how to design, build, program, and operate robots using LEGO Mindstorms kits. The robotic club also competes in local and regional robotics competitions, such as FIRST LEGO League and VEX Robotics.

Science Projects and competitions

For the first time, I mentored and coached my students for the school year of 2023 and won several categories in Science Fair competitions like, environmental science *Utilizing the Agave roots into "Tus" (jar);* chemistry, *"Feasibility Study of Banana Peels into an Organic Banana Fertilizer";* Physical Science*, " Investigating the Food Safety and Reliability Using Various Common Can Openers";* Engineering category, *"Exploring Gas Density Effects on Two Different types of Flying Orbs Performance—A Simulation Approach";* and Behavior Science, *Analyzing the Impact of Note-Taking and Research-Based Methods on Students' Engagement in Learning 7th Grade Science in SCMS."*

In School year 2024–2025, our school won several awards in Regional Science fair, where we championed all categories that we joined. The winning projects in the Junior High category encompassed a diverse range of scientific disciplines in the field of Cellular and Molecular Biology, Amaya Guzman, Aniyah Wilson, and Elleana Patterson presented their research on the "*Potential of Cull Watermelon as an Alternative Biofuel."* Meanwhile, in the area of Medicine and Health Science, Samirah Aliak and Mykhal Patten explored the "*Yield Efficiency of Diffusion and Steaming Methods for Extracting Essential Oil from Orange Rind,"* defending their findings with great expertise.

Moreover, a standout project in Behavioral Science, *"The Impact of Note-Taking on Student Retention,"* was presented by Angelina Nosie and Mykhal Patten, who answered questions with confidence and insight. In engineering, the team of Matt Amparo, Nathaniel Kenton, and Cloud Stevens created an "*Environmental Robot Model to Improve the Cleanliness and Sustainability of Residential Yards."*

This team won both in regional and in State competitions for the Plant Science category: Desiree Taylor, Timika Kenton, and Selina Yazzie, who conducted a "*Feasibility Study on Converting*

Ground Coffee into Organic Fertilizer." And lastly, in the field of Chemistry, Zyra Bearheart, Aurella Stevens, and Kaybran Jones, our 6th graders, developed a project on "*Electrical Current Transmission Capacity as a Test for Water Purity."*

International Competition

This year, San Carlos Middle School won an International honorable mention for the Girls Who Game Minecraft Education Competition, participated in by *133 countries* around the world. I helped these students with varying academic abilities and individualized learning plans. Some of my students are academically challenged, while others are highly academically accomplished. This year, I have noticed that some of my students are more socially inclined and participative than in previous years. Although I don't assume that my students will be able to grasp an understanding of the context of the lesson, I am always prepared to give instructions suited to their needs according to their learning styles.

Rationale

My curriculum unit, *"Design, Build, Animate,"* represents a *fundamental shift* from traditional science education models that rely heavily on theoretical instruction and passive learning. I chose this unit title as this enhanced hands-on approach directly addresses the growing disconnect between classroom learning and real-world application that has long plagued STEM education in the San Carlos Apache Tribe.

The historical information about the first introduction of various technologies to Apache people started when there was specific information about the early Apache contact with European technology, such that the first introduction of technology was introduced to Apache people in the late 1540s by Francisco Coronado, who has recorded the earliest account of European contact with the tribe. He pointed out that the Western Apache area in modern times was uninhabited in 1540 during his expedition that marked the beginning of Apache exposure to European technologies, and although historians made some debates about whether there was direct contact that occurred during this expedition.

In the early 1600s, Apaches arrived in the Southwest from their homeland in the North. They acquired horses of the pueblos in the early 1600s, who, in turn, had acquired them from the Spanish. Those were the transformative years, and they became great riders, even better than the Spanish. Horses allowed them to move more easily from place to place, such as transporting heavier belongings and hunting more buffalo, and gave them an advantage in raiding and war.
In the early 1600s, the process involved an intermediary trade where Spanish settlers introduced the horse to the Pueblo Indians, who in turn traded it with the Apache. But as the Spanish became more involved in governing Pueblo affairs, they forbade horse trade.
The introduction of these technologies *fundamentally transformed Apache society from their traditional ways to a more mobile*, horse-based culture that dominated much of the Southwest for centuries. The horse, in particular, became so central to Apache identity that they became renowned as some of the finest horsemen in North America.

Though they don't have specific documented evidence of the exact first time Apache people used technology for education, it was noted that in the years 1980–1990, computer-aided instruction gained widespread acceptance in schools by the early 1980s. It was during this period that drilling and practice programs were first developed for exclusive classroom use.

Schools became divided over computer preferences, with grade schools generally using Apple computers and high schools preferring DOS based machines. Hardware shortages in schools became a major issue, leaving many teachers unable to provide enough computers for students to use. The Apache communities have historically faced numerous challenges, but the advent of modern technology has transformed the way they communicate, learn, and engage economically. The technological advancements have influenced Apache cultures, focusing on communication, education, and economic opportunities. Each aspect will be explored to highlight the positive changes and potential drawbacks accompanying these advancements.

Modern technology has significantly altered educational landscapes, including those within Apache communities. Traditionally, education was imparted through oral traditions and hands-on learning, often within familial or community settings. Today, the integration of technology in education has opened up new avenues for learning and knowledge preservation among Apache youth.

One of the most notable changes is the incorporation of digital tools in classrooms. Schools serving Apache students are increasingly utilizing computers, tablets, and educational software to enhance learning experiences. Through this shift, it allows access to information but also allows for interactive learning. For instance, students can engage with multimedia resources that depict Apache history and culture, making the learning process more engaging and relevant.

Online learning platforms have also become a crucial resource, especially in remote areas where traditional educational facilities may be limited. Apache students can access courses and educational materials from anywhere, overcoming geographical barriers that previously hindered their educational opportunities. This accessibility enables a broader reach for higher education and vocational training, empowering Apache youth to pursue diverse career paths.

"However, the transition to technology-based education is not without its drawbacks. Digital divides still exist, with some Apache communities lacking reliable internet access or modern devices. This disparity can hinder the ability of some students to fully benefit from technological advancements in education. Furthermore, while technology can enhance learning, it is crucial to maintain a balance with traditional knowledge and practices to ensure that cultural teachings are not lost in the process." (USA History Timeline. (n.d.). *The impact of modern technology on Apache culture*. Retrieved June 18, 2025, from USA History Timeline

My curriculum unit is focused on integrating design thinking using tinkercad apps, construction activities using Minecraft Education in building challenges and Spike Prime for building robots, and animation projects using flipanim.com apps. In this unit, the students will experience science as a dynamic, creative process rather than a collection of static facts to memorize. In this methodology it aligns with constructivist learning theory, which emphasizes that students build understanding through active engagement with materials and concepts rather than through passive reception of information.

Contemporary educational research consistently demonstrates that students retain information more effectively and develop deeper conceptual understanding when they engage in project-based learning that connects to their lived experiences. The "*Design, Build, Animate*" the framework capitalizes on students' natural curiosity and creativity while introducing rigorous scientific methodology by inculcating their cultural values through stewardship, cultural legacy, preservation, and Apache practices. This approach is particularly crucial in an era where traditional lecture-based instruction fails to engage digital natives who expect interactive, multimedia learning experiences. In my curriculum unit, it recognizes that effective science education must compete with the engaging digital environments that surround students in their daily lives.

The design component of my curriculum unit serves as the critical foundation for scientific inquiry, teaching students to approach problems systematically in application to the real-world situation while encouraging innovative thinking. Through design challenges, students learn to identify problems, research existing solutions and innovations, brainstorm some alternatives, and iterate based on testing results. Through this process, it mirrors the authenticity of scientific methodology and engineering practices using educational applications related to Science ideas and concepts as well as engineering processes. Design thinking also develops essential 21st-century skills, including *creativity, critical thinking, and resilience in the face of failure*. Students learn that setbacks and redesigns are natural parts of the scientific process rather than indicators of inadequacy.

I chose this curriculum topic because I believed that *building activities provide the crucial bridge between abstract concepts and concrete understanding that many students need to grasp complex scientific principles.* When my students construct physical models, robots, or digital structures in platforms like Minecraft Education, they are engaging with multiple sensory pathways that reinforce learning. The tactile experience of manipulating materials, like using the merge cube and VR are one of many immersion activities I have in this curriculum unit, combined with the visual feedback of seeing their creations function, and creates powerful neural connections that support long-term retention, such as repetition of the same routine every Friday in my class. Such that building robots or 3D design, like doodling or Merge Cube, also requires students *to apply mathematical concepts, spatial reasoning, and problem-solving skills* in integrated ways that mirror how these abilities are used on a day-to-day basis and in professional contexts.

On the other hand, animation serves as both a learning tool and a demonstration of understanding, allowing students to visualize processes that would otherwise remain abstract or invisible. Through animation projects using *flipanim.com apps*, students can model molecular interactions, demonstrate physics principles, or illustrate biological processes in ways that reveal their depth of comprehension. The process of creating animations requires students to break down complex phenomena into sequential steps, like showing the culture of stewardship in nature on how the plant grows and how to take care of the plant as part of my biology lessons, promoting analytical thinking and attention to detail. Additionally, animation projects often serve as powerful communication tools, helping my students to develop the ability to explain scientific concepts and to engage in culturally responsive learning.

The hands-on nature of my curriculum unit directly addresses the needs of kinesthetic learners who struggle in traditional classroom environments while simultaneously supporting visual and auditory learners through multimedia experiences. The multi-modal approaches that are used in my class integrating the technology ensures that students with diverse learning preferences can access scientific content through their preferred channels while also developing competency in other modalities. The inclusive design of these activities helps level the playing field for students who may have been previously marginalized in traditional science classrooms, creating opportunities for success regardless of students' initial academic confidence or background knowledge.

The collaborative elements embedded throughout the "Design, Build, Animate" framework prepare my students for the team-based problem-solving that characterizes modern scientific and technological work. They will learn to divide complex tasks, integrate different perspectives, and communicate technical information effectively to their peers. These collaboration skills prove essential not only for future STEM careers but also for citizenship in an increasingly complex world where environmental, technological, and social challenges require interdisciplinary cooperation using my robotics activities with Lego. The curriculum topic of robotics will explicitly teach my students how to give and receive constructive feedback, negotiate different viewpoints, and build consensus around shared goals.

The integration of technology throughout this curriculum unit ensures that my students develop digital literacy alongside scientific understanding, preparing them for a future where technological fluency is essential across all career paths. As an educator, I do not treat technology as a separate subject; this approach embeds digital tools naturally within scientific inquiry, helping my students to understand how technology serves as both a means of investigation and a subject of study. Thus, my students learn to use technology purposefully rather than passively, developing critical evaluation skills that help them distinguish between reliable and unreliable digital sources and tools.

The assessment within the "Design, Build, Animate" framework emphasizes authentic evaluation methods of formative, summative, and unit tests that mirror how competency is demonstrated in professional settings. Rather than relying solely on traditional tests that measure memorization, the curriculum uses portfolios, presentations for the animations, peer evaluations through robot or rover building using lego sets and Spike prime, and project outcomes to assess student learning through building using Minecraft Education build apps. This approach provides multiple opportunities for students to demonstrate understanding while developing communication skills and self-reflection abilities. The assessment strategies also support formative learning by providing ongoing feedback that helps students improve their work throughout the project cycle rather than only at predetermined endpoints.

The long-term vision of this curriculum unit extends beyond immediate academic outcomes to prepare students for lifelong learning and adaptive problem-solving in a rapidly changing technological landscape. By emphasizing process over product, creativity alongside accuracy, and collaboration in addition to individual achievement, the *"Design, Build, Animate"* approach cultivates the habits of mind that enable continued growth and innovation. Students who experience science as an active, creative, collaborative endeavor are more likely to pursue STEM fields and to bring innovative perspectives to whatever careers they ultimately choose, like engineering and design career paths and other STEM careers. This curriculum investment in hands-on, integrated learning represents a commitment to developing not just scientifically aligned learners but creative problem-solvers prepared to address the complex challenges of the future.

Why did I choose this topic?

Why the *"Design, Build, Animate"* approach? In my 24 years of teaching experience, I observed some challenges in traditional science education. I have witnessed firsthand the limitations of traditional science education approaches that rely heavily on textbook readings, lecture-based instructions, and frontloading science vocabulary terms along with the scientific facts.

Most of my students, who often struggle to see the relevance of scientific concepts to their daily lives, are usually leading to disengagement and a perception that science is boring or too difficult. I observed that many students might learn to recite formulas and definitions for tests but often failed to understand the underlying principles or apply their knowledge to solve real-world problems. The disconnection between the theoretical learning and practical applications became particularly evident when students excelled on paper-and-pencil assessments yet struggled with hands-on laboratory activities or couldn't explain how scientific concepts related to current events or technological innovations.

Personal Experiences with Hands-On Learning

My own educational journey was transformed when I encountered hands-on learning experiences that made abstract concepts tangible and engaging. I remember the moment when I asked my students to build a simple electric circuit that made Ohm's law suddenly make sense, or also when my class created a model of the ecosystem; it helped me understand the complex ecological relationships. These experiences taught me that learning becomes meaningful when students can manipulate materials, test hypotheses, and see immediate results from their actions. As an educator, I wanted to recreate those *"aha moments"* for my students, knowing that hands-on experiences create lasting memories and deeper understanding that passive instruction methods often fail to achieve.

Addressing Specific Student Needs and Interests

Today's students are digital natives who have grown up surrounded by interactive technology and expect learning experiences that match their technological fluency. I noticed that students who struggled with traditional classroom instruction often excelled when given opportunities to work with their hands, create digital content, or engage in collaborative projects. In this unit, I would like to incorporate my lesson on the Triple E approach, (Kolb, 2017). International Society for Technology in Education. Many of my students expressed interest in gaming, robotics, and digital media creation but didn't see connections between these interests and science education. I recognized the need to bridge this gap by incorporating technologies and platforms like creating videos through canvas, 3d designs using tinkercad and using AR/VR (Augmented Reality and

Virtual Reality) for the immersion of Science and Technology lessons while maintaining rigorous academic standards and learning objectives.

Inspiration from Technology Integration

The combination of robotics, animation, and platforms like Minecraft Education represents a convergence of powerful educational tools that address different learning styles in my 8th Grade class and also preferences. Robotics provides physical, tactile experience that kinesthetic learners need while teaching programming through fundamentals of coding and engineering principles. On the other hand, animation allows students to visualize complex processes and demonstrate their understanding through creative expression. Minecraft Education offers a familiar, game-based environment where students can build, experiment, and collaborate while exploring scientific concepts. I was inspired by the potential to create a comprehensive learning ecosystem where these technologies complement each other and provide multiple pathways for student success.

Meeting Standardized Goals and Objectives

My curriculum unit approach directly addresses several unified school district priorities and educational standards that emphasize 21st-century skills, such as STEM or STEAM integration and technology literacy. Our school district—the San Carlos Unified School District—has been committed to preparing students for careers in rapidly evolving technological fields, and this curriculum provides authentic experiences with the tools and thinking processes used in real-world settings. The hands-on approach also supports our school's focus on project-based learning and collaborative problem-solving, which we initially started 2 years ago when we were the recipient of the Girls who Game – Minecraft Education program under Microsoft and Dell Company ("minecraft education", 2019). Additionally, this curriculum aligns with Next Generation Science Standards (NGSS) and Arizona Standards that emphasize engineering design processes, scientific practices, and cross-cutting concepts.

Responding to Educational Research

My current educational research consistently demonstrates that active learning approaches produce better outcomes than passive instruction methods. Studies in cognitive science show that students learn more effectively when they are engaging with multiple senses, working with concrete materials, and applying knowledge in meaningful contexts. My curriculum unit incorporates evidence-based practices including *constructivist learning theory*, social learning through collaboration, and authentic assessment methods, which are culturally based activities such as incorporating Wikiup (Apache Shelter) through their builds in Minecraft and presenting the Apache Cultural Center as their output in technology immersion, and Envi-Robots or Moon Rovers, whose main function is to detect moisture and water content, by which water plays an important role in Apache life. The curriculum design reflects what we know about how the brain learns best, particularly for middle school learners who benefit from hands-on experiences, collaborative work and peer interaction.

Preparing Students for Future Careers

With the rapid pacing of technological advancement, I chose to focus on developing adaptable thinking skills, creativity, and problem-solving abilities that will serve students regardless of their eventual career paths. The design-build-animate approach teaches students how to learn new tools quickly using apps online like www.tinkercad.com app for architectural and engineering builds and www.flipanim.com for animation activities in science, and using Spike prime for automation and robotics with the support of the generative AI, it also iterates based on feedback and collaborates effectively with diverse teams—skills that remain valuable across all educational contexts.

This curriculum unit focuses on creating Inclusive Learning Opportunities such that traditional science education often inadvertently excludes students who don't fit the stereotype of a "science person" or who haven't had exposure to scientific thinking at home. The hands-on, creative approach of this curriculum provides multiple entry points for student success and allows different types of intelligence and creativity to flourish. Students who struggle with traditional academic tasks often excel when given opportunities to build, design, and create. This curriculum choice reflects my commitment to making science education accessible and engaging for all students, regardless of their background or initial confidence level.

This unit fosters innovation and creativity because science at its core is a creative endeavor that requires imagination, experimentation, and willingness to take risks. Traditional education approaches often emphasize getting the "right" answer rather than exploring multiple possibilities or learning from failure. I chose this topic because it celebrates creativity and innovation while maintaining scientific rigor and connecting with the Apache culture. Students learn that there are often multiple solutions to complex problems in the community and that the process of discovery is as important as the final outcome of their Project-based learning activity. This mindset prepares students not just to consume scientific knowledge and funds of knowledge from the Apache community, but to contribute to scientific advancement.

Personal Mission as an Educator

Ultimately, I chose this topic because it aligns with my core belief that education should ignite curiosity, build confidence, and prepare students to be thoughtful, capable citizens in this country who can contribute to solving the world's challenges. The *"Design, Build, Animate"* approach embodies my vision of science education that is joyful, meaningful, and transformative. *According to Gholdy (Unearthing Joy, 2023)* , "Joy *can infuse our relationship building with students, as we check in on their hearts and on their wellness." (Gholdy Muhammad, p. 74).* When students leave my classroom having experienced success in designing solutions, building prototypes, and communicating their ideas through animation, they carry with them not just scientific knowledge but also the confidence to tackle complex problems and the skills to collaborate effectively with others. This curriculum choice reflects my commitment to nurturing the next generation of innovative thinkers and problem-solvers.

Instructional Guide

The content objectives in my unit curriculum are to help bridge the gap between traditional Apache science instruction and innovative technology integration, offering students dynamic pathways to understand scientific concepts through hands-on design, construction, and digital creation. These objectives focus on developing both scientific understanding and technological literacy while fostering 21st-century skills essential for future success as well as preserving Apache culture through their design, builds and animation. I am also incorporating the CRAIS tool—*using* the Triple E framework that was adapted for adult education and provides practical strategies for integrating technology to support engagement, enhancement, and extension in my Science class(Schatzke, 2019.)It is important that teachers view technology as a tool that can improve student engagement, communication, and collaboration; close achievement gaps; modify work for individual students to meet individual learning styles; and put all students on a level playing field to close learning gaps (US Department of Education, 2017).

My curriculum unit applies scientific investigations that include identifying issues and problems, researching alternatives and solutions, developing prototypes through project-based learning, testing, and summarizing feedback for improvement. This approach aligns with constructivist principles that emphasize inquiry, collaboration, and real-world problem solving (Blumenfeld et al., 1991; Kokotsaki, Menzies, & Wiggins, 2016). Project-based learning has been shown to enhance student engagement and deepen understanding in STEM contexts by integrating design thinking and iterative refinement (Krajcik et al., 2023; Rodriguez-Sanchez et al., 2024).

Through integrating the scientific methods with the design thinking approach to the real-world challenges, it will encourage a systematic approach to *creative problem-solving approaches*. In this method, I recommend using the Minecraft education platform in order to identify the issues and discuss them with the class, leading to a creative problem-solving approach. In addition, integrating building digital models helps demonstrate scientific principles through developing computational thinking skills like creating builds. In this curriculum unit, *the designing* approach through Minecraft education is being utilized through building an Apache Culture Center.

The Apache Culture Center represents the hub of Apache history, culture, and tradition. It consists of archives containing documents and cultural evidence. Often referred to as the “Window on Apache Culture,” the museum offers visitors insight into the spiritual beginnings of the Apache people, including the Mountain Spirit Dancers known as “Ga’an” and the sacred Sunrise Ceremony—a four-day coming-of-age ritual for young women entering womanhood (Stokrocki, 2025; Rubio, 2025).

Furthermore, the San Carlos Apache Cultural Center represents an important model of an Indigenous-controlled cultural institution, where the community maintains authority over how their culture is presented and interpreted, ensuring both authenticity and respect in cultural education and preservation efforts.

Other than including these elements for Minecraft builds and figures through various tools, I also encourage my students to conduct additional research to enrich their projects. This includes exploring historical artifacts and contemporary Apache artistic expressions such as posters, paintings, camp dresses, and ceremonial regalia. These elements help bridge past and present cultural traditions, fostering deeper engagement and cultural relevance (Curley, 2015; Justo, 2024).

The next activity for designing an Apache Culture Museum is *leading the students to understand the dimension of the building* following the components of the building and its measurements and creating a 3D design including the inside and outside features of the building. In this activity, I am encouraging my students to take measurements through box counting in the Minecraft setting. Integration of taking the perimeter and the area of the museum is important before building.

Sample lesson Plan for Minecraft Builds education:

Arizona Standard Objective: AZESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

- **Learning Target 1:** Students brainstorm different museum layouts, exhibit designs, and interactive elements before selecting optimal solutions.
- **Learning Target 2:** Students identify the need to preserve Apache cultural knowledge and design museum spaces within Minecraft's material and spatial constraints.
- **Learning Target 3**: Students establish specific museum requirements, including accessibility, educational value, and cultural authenticity.
- **Learning Target 4**: Students showcase Apache traditional ecological practices and modern conservation methods in their exhibits.

Supporting Standard: **5-LS2-1**: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

- Students create exhibits showing traditional Apache ecological knowledge and sustainable practices in desert ecosystems.

HS-ETS1-2: Design solutions to complex real-world problems by breaking them down into smaller, more manageable problems that can be solved through engineering.

- Learning Target: Students address the complex challenge of cultural preservation through digital media by breaking it into manageable exhibit components.

HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints.

- Learning Target: Students evaluate their museum's effectiveness in cultural education while considering technical limitations and cultural sensitivity.

HS-ESS3-2: Evaluate technologies based on how they affect the carrying capacity of ecosystems and biodiversity.

- Learning Target: Students research and present how traditional Apache technologies supported environmental sustainability.

Engagement Activity:

Challenge: Apache Culture Center Building (Minecraft builds)

Project-Based Learning:

Students will design, build, and present an Apache cultural museum in Minecraft while applying engineering design principles, understanding ecosystems, and exploring the intersection of technology with cultural preservation. This project integrates Arizona Science Standards with culturally responsive education, honoring Arizona's Indigenous heritage.

- Learning Target: Students identify the need to preserve Apache cultural knowledge and design museum spaces within Minecraft's material and spatial constraints.

Cross-Cutting Concepts Integration

- **Patterns**: Students identify patterns in Apache architectural designs and incorporate them into their builds
- **Systems and System Models**: Museums function as systems with interconnected exhibits and visitor pathways
- **Energy and Matter**: Exploration of how Apache peoples utilized energy and matter in their traditional technologies
- **Structure and Function**: Museum layout and exhibit design must serve specific educational functions

Engagement Activities

Phase 1: Cultural Research and Design Planning (Week 1-2)

Hook Activity: Virtual field trip to existing Apache cultural centers and museums using online resources. Students view 360-degree tours and identify effective exhibit strategies.
Research Component: Students research Apache history, traditional technologies, ecological knowledge, and contemporary culture using primary sources, tribal websites, and academic resources. They create research portfolios documenting:

- Traditional dwelling structures (wickiups, tipis)
- Agricultural land and crops to grow in and within the parameter of the Apache Museum
- Resources for the research and citations
- Spiritual and ceremonial elements (approached with appropriate respect and consultation)
- Contemporary Apache communities and contributions

Design Challenge: Teams create detailed blueprints for their museum sections using graph paper or digital tools. They may use the following apps:

a. Minecraft education (Built -in computer apps in San Carlos)
b. Google earth
c. Canva for portfolio making and documentation
d. Powerpoint presentation or Canva for video editing

For Project presentation, it is best to consider the following points:

- Parameter and area of the Minecraft builds
- Educational objectives for each exhibit
- Digital etiquette when collaborating with other teams
- Cultural authenticity and respectful representation

Phase 2: Minecraft Construction (Week 3-5)

Collaborative Building
In this phase, student teams construct their museum sections, applying engineering design principles. Each team takes responsibility for specific exhibits:

- Traditional Hall and displays
- Ecological Knowledge Center and archives section
- Contemporary Apache Life and artifacts
- Interactive Learning Spaces
- Ceremonial Spaces (handled with cultural sensitivity) and music used

Engagement activities: In this activity, which I call *"Technical Integration," students* are using brick stone or colored tufa stone for museum building. Prior to building, students must know all of the commands used for building, crafting and creating the Apache Museum. These elements include but are not limited to:

a. Command blocks
b. Interactive design
c. Layouts
d. Video setup
e. Storyline

As the students maintain engineering notebooks to document their design decisions following the concepts of the Apache Culture Center setup, challenges faced, and solutions implemented. They photograph their building process and reflect on iterations.

Documentation Process: Students maintain engineering notebooks documenting their design decisions, challenges faced, and solutions implemented. They photograph and videograph their building process and reflect on iterations.

Phase 3: Scientific Analysis and Cultural Integration (Week 4-6)

In this phase, I am integrating the ecosystem by accurately representing the surrounding landscapes of San Carlos Apache Land, where Apache people traditionally lived, in this activity, the students will include the following:

- Native plant species like Agave and their traditional uses
- Corn, squash and sunflowers
- Domesticated animals
- Crown dancers and sunrise dance area setup
- Apache practices

Students will have an opportunity to incorporate analysis of technology using the modern equivalents in analyzing the components of their builds through the following points:

- Sustainability of the Apache Cultural Center
- Efficiency and development
- Innovation and its adaptation
- Engineering design
- Environmental impacts
- Scientific principles underlying traditional practices

Data collection in 8th grade plays an integral and essential role in my curriculum unit as the students survey how the community would visit the virtual museum and its cultural appropriateness, the engagement levels of the Apache people and the ease of navigation in Minecraft builds and most especially how these aspects integrate with the learning effectiveness through Science projects and integration with Apache culture.

Assessment and Exit Tickets

Exit Ticket 1: Engineering Design Reflection (Essay Writing)

Question: "Describe the engineering design process you used to create your Apache cultural museum exhibit. In your response, explain how you identified the problem your exhibit needed to solve, what constraints you faced working in Minecraft, and how you tested and improved your design. Provide specific examples of at least two design iterations you made and explain the scientific reasoning behind your changes. Finally, evaluate how well your final design meets the original criteria you established for educating visitors about Apache culture while respecting cultural traditions."

Standards Addressed: MS-ETS1-1, MS-ETS1-2, MS-ETS1-3

Scoring Criteria:

Scoring criteria for Engineering Design Reflection (Essay Writing)	
Clear identification of design problem and constraints	25%
Detailed description of design process with specific examples	30%

Evidence of testing and iteration with scientific reasoning	25%
Thoughtful evaluation of final solution's effectiveness	20%
Total:	100%

Exit Ticket 2: Ecosystem and Cultural Knowledge Integration

Question: "Apache people have lived sustainably in the Sonoran Desert for thousands of years, developing sophisticated ecological knowledge. Choose one traditional Apache practice you featured in your museum (such as food procurement, water management, shelter construction, or seasonal migration) and analyze it from both cultural and scientific perspectives. Explain the scientific principles that make this practice effective for desert survival, how it demonstrates understanding of ecosystem relationships, and why this knowledge remains relevant for modern environmental challenges. Support your analysis with specific examples from your museum exhibits and discuss how traditional ecological knowledge compares to contemporary scientific approaches to similar challenges."
Standards Addressed: 5-LS2-1, MS-ESS3-3, HS-ESS3-2
Scoring Criteria:

- Accurate description of chosen traditional practice - (20%)
- Clear explanation of underlying scientific principles - (30%)
- Analysis of ecosystem relationships and sustainability - (25%)
- Connection to modern environmental applications - (15%)
- Use of specific examples from museum exhibits - (10%)

Teaching Strategies

In this curriculum unit, students will be able to assess other teams' museum sections using the criteria of the following components of the peer evaluation rubric, such as cultural accuracy, scientific content, design effectiveness and area of the building. Additionally, students will create a reflection portfolio as they compile their research for the Apache Museum, design sketches, use their engineering notebooks, document through still pictures or videos and use peer feedback in demonstrating their learning journey in building each element in the Minecraft builds.

Presentation Component:
In this activity, I am leading my students to have a group presentation of their museum sections to authentic audiences, including Apache community members (when possible), parents, and other classes, explaining their design choices and cultural research. During the knowledge expo activity, STEM has a showcase of the students' works via PBL (project-based learning outputs). One of the presentations that they need to present is their video presentation of their Minecraft builds.

Cultural Considerations and Community Connections

In this curriculum unit, the project requires careful attention to cultural sensitivity and accuracy; thus, it is recommended that before creating or advocating this project, we consult the local Apache tribal education departments or cultural centers to check if we did not violate any cultural sensitivity issues or concerns, we as well invite elders or tribal members as guest speakers to give us details of information about the building of the Apache Cultural Museum, and we ensure that students understand the difference between public cultural knowledge and sacred/private traditions. In one way or another, this will help us emphasize a respectful representation and avoid stereotyping or oversimplification. Through connecting students with contemporary Apache communities, we know that we can be successful with our activity as we address the funds of knowledge and embed my curriculum unit with the CRAIS tool elements. This approach honors the lived experiences and cultural assets of Indigenous learners, aligning with the Funds of Knowledge framework (González, Moll, & Amanti, 2005) and the principles of culturally sustaining pedagogy embedded in CRAIS (Arizona Department of Education, 2023).

Digital Citizenship Assessment

Students reflect on responsible representation of Indigenous culture in digital spaces and their responsibilities as creators of cultural content. Another component that is part of my lesson and teaching strategies is the extension opportunities of my students, as I consider differentiated instructions involving activities for struggling, middle and advanced students. For advanced students, they can create virtual reality tours of the museum and identify the important cultural elements included in the museum, describe its engineering works and also collaborate with other Apache schools for any authentic feedback about the builds. The average student may organize community presentations at the local museums and cite the importance of preserving the Apache language and traditions through artifacts and documents. Lastly, the struggling students can create a digital archive through animation and identifying the commands for crafting using the Minecraft tools.

This comprehensive project demonstrates how Minecraft can serve as a powerful platform for interdisciplinary learning, combining Arizona Science Standards with culturally responsive education that honors Indigenous knowledge systems while developing students' scientific thinking and engineering design skills.

Final Output:

Link: SCMS SPRING CHALLENGE - *San Carlos Middle School earned an Honorable Mention in the global competition, standing proudly alongside winning entries from three other countries. Their Minecraft build—an authentic and culturally rich digital recreation of the Apache Museum in San Carlos, Arizona—captivated judges with its creativity, heritage, and attention to detail.*

Applications and Implications

As a science educator, I recognize that integrating technology into 8th-grade science instruction prepares my students for an increasingly digital world where scientific literacy and technological competence are essential for informed citizenship and career success. This approach transforms students from passive consumers of scientific information into active creators who use technology as a tool for investigation, communication, and innovation.

The hands-on nature of robotics programming, animation creation, and digital modeling provides multiple pathways for student success while addressing diverse learning styles and interests. Students who may struggle with traditional assessments often excel when given opportunities to demonstrate understanding through creative technology projects.

Furthermore, this integrated approach mirrors how science is actually conducted in professional settings, where researchers routinely use advanced technology tools, collaborate across distances, and communicate findings through digital media. By experiencing science through technology integration, students develop both the technical skills and scientific thinking necessary for future academic and career success.

Teaching Strategies

Curriculum Context: "Design, Build, Animate" - Technology Integration in 8th Grade Science

Teaching Philosophy and Approach

The "Design, Build, Animate" approach in my curriculum unit represents a balanced integration of technology-enhanced learning with foundational science instruction. This approach recognizes that effective STEM education would complement and not replace the traditional teaching methods, providing students with both conceptual understanding and hands-on application opportunities. At San Carlos Middle School, we maintain our commitment to teaching essential science concepts while strategically incorporating project-based learning that engages students through design challenges, construction activities, and digital creation.

Curriculum Setting and Student Population

In this curriculum unit, I specifically designed it for 8th-grade science students at San Carlos Middle School, serving a diverse learning community that includes students from the San Carlos Apache Reservation and neighboring communities like Bylas and Globe, Az as well. The curriculum honors our local cultural perspectives while introducing the cutting-edge scientific concepts, creating meaningful connections between the traditional knowledge systems and modern scientific understanding. Our students shall bring varied technological backgrounds and learning preferences, making the multi-modal approach of design, building, and animation particularly valuable for ensuring all learners can access and engage with complex scientific concepts.

Strategy 1: *Integration of Technology blended with Traditional Apache Science Application*

The curriculum seamlessly blends hands-on engineering projects with digital tools to create comprehensive learning experiences. Students engage with robotics programming to model scientific phenomena, use animation software to visualize complex processes, and construct both physical and virtual models using platforms like Minecraft Education. The integration of blended technology allows my students to experience science as both a theoretical discipline and a practical toolkit for solving real-world problems. The technology components are carefully selected to enhance and not to distract from core learning objectives, ensuring that the digital tools will serve as meaningful extensions of scientific inquiry.

Example application is the Augmented Reality using the Merge Cube apps:

a. Merge Cube apps for teaching the core lessons in biology, physics and Chemistry. It is a foam cube with unique designs on each side that lets you hold digital 3D objects using augmented reality technology. Hold digital 3D objects (holograms), enabling an entirely new way to learn Science and STEM.
Link: Merge Cube | AR/VR Learning & Creation

Science Education activity examples:

- Explore a galaxy in the palm of your hand, hold fossils and ancient artifacts, explore a DNA molecule, investigate the Earth's core, dissect virtual specimen. Link: MergeReadability
- Interactive science simulations through apps like Merge Explorer
- Highly engaging simulations and digital teaching aids you can touch, hold and interact with

Strategy 2: *Project-Based Learning Framework*

The curriculum employs a project-based approach that engages students in authentic scientific investigations spanning multiple weeks. Students work in collaborative teams to design solutions to engineering challenges, build prototypes that demonstrate scientific principles, and create digital presentations that communicate their findings to authentic audiences. Projects are structured to include multiple opportunities for iteration and improvement, teaching students that failure and revision are natural parts of the scientific process. This approach develops both content knowledge and essential skills, including critical thinking, collaboration, and communication.

Application: Tinkercad
Link: Tinkercad

Science and Engineering Activity examples:
- Perfect for 3D design projects, circuits, and coding
- Students can design everything from architectural models to electronic circuits

Strategy 3: *Design Thinking and Engineering Process*

Central to the curriculum is the integration of engineering design thinking with scientific inquiry. Students learn to identify problems, research existing solutions, brainstorm creative alternatives, prototype ideas, test results, and iterate based on feedback. This process is applied to both physical construction projects and digital creation activities, helping students understand that design thinking is a versatile problem-solving approach applicable across disciplines. The engineering design process provides a structured framework that supports student success while encouraging creativity and innovation.

- Foundation for block-based programming
- Students can use CoSpaces to take their block coding skills learned in Scratch to the next dimension. Merge Cube - ELRI

- Excellent for creating games, animations, and interactive stories

Grok (AI-Powered Learning)

- Grok can design real-world STEM problems for students to tackle. Instead of asking students to memorize formulas, Grok encourages them to apply their knowledge in practical, meaningful ways (Link: Learning with VR & AR - Merge Cube)
- Problem-Based Learning Scenarios: turning theorists into TINKERERS

Strategy 4: *Robotics and Programming Integration*

Robotics serves as a powerful vehicle for teaching scientific concepts while developing computational thinking skills. Students program robots to collect environmental data, model biological processes, and demonstrate physics principles such as motion, forces, and energy transfer. Programming activities are scaffolded to support learners with varying levels of prior experience, beginning with visual programming languages and progressing to more complex coding challenges. The robotics component connects abstract scientific concepts to tangible, observable outcomes that students can manipulate and modify.
Science and Engineering Education examples:

- Scratch
- Spike prime

ProjectBoard (Free)

- ProjectBoard is the platform to share your projects with a broad audience, gain valuable feedback, and build a showcase that highlights your STEM journey. MERGE AR/VR Cube and Headset – The Science Bank
- Students can document and share their STEM projects
- Great for building digital portfolios

Padlet (Free)

- Teachers post a prompt, either written or a video, and invite students to record and share their own video responses. www.padlet.com

- Continue engaging their students in STEM activities MERGE Cube (2 Pack) - Fun & Educational Augmented Reality STEM Toy for Kids, Learn Science, Math, and More 2 Packs : Amazon.co.uk: Toys & Games through video discussions
- Perfect for project presentations and peer feedback

Strategy 5: *Digital Animation and Visualization*

Animation projects allow students to create visual representations of scientific processes that would otherwise be difficult to observe directly. Students use animation software to model molecular interactions, demonstrate ecosystem relationships, and illustrate physics concepts such as wave behavior and energy transfer. The animation process requires students to break down complex phenomena into sequential steps, promoting analytical thinking and deep understanding.

These projects also serve as powerful assessment tools, revealing student thinking through their creative interpretations of scientific concepts.

Science Education activity examples:

Moovly (Freemium)

Primary Functions:

- Huge royalty-free media library with over 500,000 videos, illustrations, photos, sounds, and music Merge Cube | AR/VR Learning & Creation
- Moovly Studio editor with a new and improved user interface for a more flexible and intuitive experience Merge Cube | AR/VR Learning & Creation
- Video generator Moovly Bots automatically creates content based on templates and user data

Flip animation

- Simple, intuitive interface perfect for beginners
- Exploring the various tools to create your first animation Merge cube | TPT
- Encourages creativity and storytelling
- Introduces basic animation principles

Z Space

- Activate prior knowledge
- Inquiry-based learning
- Collaborative problem solving
- Multisensory engagement

Learning Outcomes:

- Understanding of frame -by-frame animation
- Digital art skills development
- Sequential thinking and planning
- Creative expression through motion graphics
- Basic understanding of timing and movement

Strategy 6: *Augmented Reality through Minecraft Education Platform Applications*

Minecraft Education provides a familiar, engaging platform for scientific modeling and collaborative investigation. Students construct scale models of cellular structures, design sustainable ecosystems, and build engineering solutions to environmental challenges within the game environment. The platform's collaborative features mirror the teamwork essential in professional scientific settings, teaching students to share ideas, coordinate efforts, and integrate diverse perspectives. Virtual field trips and simulations within Minecraft allow students to explore environments and phenomena that would be impossible to access in traditional classroom settings.

Assessment and Evaluation Strategies

The curriculum employs multiple assessment strategies that align with the varied learning experiences students encounter. Traditional assessments measure content knowledge, while performance-based evaluations assess students' ability to apply scientific principles in design and construction projects. Digital portfolios document student learning progression and provide opportunities for reflection and self-assessment. Peer evaluation activities teach students to provide constructive feedback and learn from alternative approaches to problem-solving.

Community and Cultural Connections

The curriculum explicitly connects scientific learning to local community issues and cultural perspectives, particularly honoring the knowledge systems of the San Carlos Apache community. Students investigate local environmental challenges, explore traditional ecological knowledge, and consider how scientific understanding can support community goals. This approach helps students see science as relevant to their lives and communities while developing respect for diverse ways of understanding the natural world.

Professional Development and Implementation

Successful implementation of this curriculum requires ongoing professional development for educators, including training in emerging technologies, project-based learning strategies, and culturally responsive teaching practices. SCMS teachers collaborate to share resources, troubleshoot technical challenges, and refine instructional approaches based on student outcomes. The curriculum is designed to be adaptable, allowing teachers to modify activities based on available resources, student needs, and local contexts while maintaining core learning objectives.

Future Directions and Scalability

The "Design, Build, Animate" curriculum is designed as a model that can be adapted for different grade levels, subject areas, and community contexts. As students demonstrate success with integrated technology approaches, the curriculum can expand to include more advanced tools and more complex projects. Partnerships with local businesses, higher education institutions, and community organizations provide opportunities for authentic audience engagement and real-world problem-solving experiences that extend learning beyond the classroom walls.

Robotics and Programming Integration

- **Master basic programming concepts,** including sequences, loops, conditionals, and variables, through hands-on robotics projects that demonstrate physics principles such as motion, forces, and energy
- **Explore sensor technology and data collection** using robotic platforms to gather environmental data, measure physical phenomena, and create automated systems that respond to scientific variables
- **Connect programming logic to scientific reasoning** by designing robots that can model biological processes, demonstrate chemical reactions, or simulate astronomical phenomena

Digital Animation and Scientific Visualization

- **Create animations that demonstrate scientific processes,** including molecular interactions, cellular functions, ecosystem relationships, and physical phenomena that are difficult to observe directly
- **Develop multimedia communication skills** by producing animated explanations of scientific concepts that can be shared with diverse audiences, incorporating accurate scientific vocabulary and visual representations
- **Use animation software to model and test hypotheses** about how changes in variables affect scientific systems, creating visual experiments that complement hands-on laboratory work

Data Analysis and Digital Tools

- **Utilize technology tools for data collection and analysis,** including digital sensors, spreadsheet applications, and graphing software, to investigate scientific phenomena and present findings professionally
- **Develop digital literacy skills** for evaluating online scientific sources, creating digital portfolios of work, and communicating scientific findings through various media formats
- **Integrate real-time data sources** such as weather monitoring, environmental sensors, and online databases to connect classroom learning with current scientific research and global phenomena

Link: (248) Using Padlet for class interaction - YouTube

Collaborative Technology Projects

- **Participate in team-based technology projects** that require coordination, communication, and shared problem-solving to complete complex scientific investigations and engineering challenges
- **Use digital collaboration tools** including cloud-based platforms, video conferencing, and shared workspaces, to work with peers on scientific projects and communicate with experts in the field
- **Develop presentation skills using multimedia tools** to share scientific discoveries, defend design choices, and explain complex concepts to various audiences through digital storytelling

Link: parts of the computer for 3rd-5th Grade

Cross-Curricular Technology Applications

- **Connect science concepts with other disciplines** through technology projects that incorporate mathematics, social studies, language arts, and the arts to demonstrate the interdisciplinary nature of scientific work

- **Explore careers in STEM fields** through technology-based projects that mirror real-world applications in engineering, biotechnology, environmental science, and emerging technological fields
- **Address global challenges** using technology tools to research, model, and propose solutions to issues such as climate change, sustainable energy, and public health

Digital Citizenship and Ethics in Science

- **Understand ethical considerations in technology use,** including data privacy, intellectual property, and responsible use of digital tools in scientific research and communication
- **Develop critical evaluation skills** for assessing the reliability of digital sources, understanding bias in online information, and distinguishing between scientific evidence and opinion
- **Practice responsible digital communication** when sharing scientific work online, collaborating with peers, and engaging with scientific communities through appropriate digital platforms

Final output:

Rings of Responsibility - Digital Citizenship

Innovation and Creative Problem-Solving

- **Design original solutions to scientific challenges** using available technology tools, demonstrating creativity while maintaining scientific accuracy and following safety protocols
- **Iterate and improve designs** based on testing results, peer feedback, and scientific evidence, developing resilience and persistence in problem-solving processes
- **Explore emerging technologies** and their applications to scientific research, including artificial intelligence, virtual reality, and advanced simulation software

Assessment Through Technology Integration

- **Create digital portfolios** that document learning progress, reflect on scientific thinking development, and showcase completed projects using various technology platforms
- **Engage in peer evaluation** using digital tools to provide constructive feedback on scientific work, design projects, and collaborative efforts
- **Demonstrate learning through authentic assessments** including video presentations, interactive models, programmed demonstrations, and digital storytelling that show deep understanding of scientific concepts.

Teaching Plan

15-Day Teaching Routines and Strategies: Design, Build, Animate—Technology Integration in 8th Grade Science

Weekly Routine Structure

Day	Focus Area	Skill Development	CRAIS Alignment
Monday	Research & Digital Literacy	Online research, vocabulary building	Student voice, cultural relevance
Tuesday	Nature Journaling & Documentation	STEM animation, observation	Community connections, experiential learning
Wednesday	STEM Project-Based Activities	Engineering, design thinking	Inquiry-based learning, collaboration
Thursday	Gamification & Interactive Learning	Programming, simulations	Engagement, multimodal Access
Friday	Assessment & Reflection	Communication, digital portfolios	Student agency, authentic assessment

Daily Framework:

CRAIS-Aligned Lesson Components

◈ Week 1: Foundations & Exploration

Essential Question: How can technology help us understand and preserve our local environment?

- Monday:
    - Introduce key vocabulary (e.g., erosion, biodiversity, prototype)
    - Students research local environmental issues using curated online sources
    - CRAIS: Embed community relevance by focusing on Apache lands or local ecosystems

Tuesday:

- Nature walk with tablets or phones to document flora/fauna
- Students sketch and animate findings using Canva or zSpace
- CRAIS: Honor Indigenous knowledge systems through observation and storytelling

Wednesday:

- Begin building models (e.g., erosion barriers, water filters) using recycled materials
- CRAIS: Encourage collaborative problem-solving and design thinking

Thursday:

- Use Minecraft Education or zSpace to simulate environmental solutions
- CRAIS: Gamify learning to increase engagement and accessibility

Friday:

- Students present findings in digital portfolios (Padlet, Google Slides)
- CRAIS: Reflect on learning through culturally sustaining formats

Week 2: Design, Build, Animate

Essential Question: How can we use technology to tell stories about science and culture?

Monday:

- Research Apache traditions (e.g., Ga'an dancers, Sunrise Ceremony)
- Students explore how cultural artifacts connect to scientific principles (e.g., physics of movement)
- CRAIS: Integrate funds of knowledge and cultural storytelling

Tuesday:

- Animate cultural scenes using Canva or Scratch
- CRAIS: Support multimodal expression and student creativity

Wednesday:

- Build interactive museum exhibits in Minecraft (e.g., Apache Culture Center)
- CRAIS: Bridge past and present through student-led design

Thursday:

- Program interactive features (e.g., NPC guides, quizzes)

- CRAIS: Embed student voice and choice in digital spaces

Friday:

- Peer review and feedback using CRAIS-aligned rubrics
- CRAIS: Promote equity through transparent assessment and revisionWeek 3: Showcase & Reflect

Essential Question: How do our projects reflect who we are and what we value?

- Monday–Thursday:
    - Finalize builds, animations, and presentations
    - Prepare for community showcase or virtual gallery walk
    - CRAIS: Invite family and community members to view student work
- Friday:
    - Reflect on learning journey using Flipgrid or Padlet
    - CRAIS: Encourage metacognition and cultural pride

Assessment Tools

- CRAIS-aligned rubrics for:
    - Research depth
    - Cultural integration
    - Design creativity
    - Communication clarity
- Digital portfolios (Google Slides, Padlet)
- Peer and self-assessment forms

15 – Day Challenge
8th Grade Science
(Atoms and Molecules)

Topic focus: Mining and Molecular Transformation: A Digital Exploration
Maydafe Cherryl Clark

Lesson Overview:

In this innovative lesson, students will explore chemical reactions and atomic conservation through a simulated mining and mineral processing experience. Using AI-powered virtual reality simulations and robotic modeling tools, students will investigate how atoms and molecules combine and rearrange during chemical reactions to form new compounds. The lesson emphasizes that while the arrangement of atoms may change during these reactions, the total number of each type of atom remains constant. Students will use digital mining robots to "extract" virtual minerals, then utilize molecular modeling software to analyze and manipulate the atomic structures, demonstrating real-world applications of chemical reactions while reinforcing the fundamental principle of conservation of matter.

Keywords: **This lesson combines traditional chemistry concepts with cutting-edge technology, allowing students to explore how atoms and molecules interact through digital simulations while understanding the role of AI and robotics in modern chemical analysis and mining operations. The focus remains on the fundamental principle that atoms are conserved during chemical reactions, now enhanced through technological visualization and exploration.**

- **Atomic and molecular structures**
- **Chemical reactions and conservation of matter**
- **Digital simulations and AI-assisted modeling**
- **Robotic applications in chemical processes**
-

(AZ Science Standard) – Middle School (8th Grade)

8.P1U1.1 – Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.

Boulders:

- **Learning Target 1 -** Explain the Law of Conservation of Mass

Mining and minerals: Students will explore how mining processes involve chemical reactions that rearrange atoms to extract valuable minerals while maintaining the principle of atom conservation.

- **Learning Target 2- Analyze Chemical Equations**

Mining and minerals:

- Identify common minerals and their chemical compositions
- Recognize that mining involves chemical processes
- **Learning Target 3-** Construct and Interpret Molecular Models

Mining and Minerals:

- Understand basic atom conservation principles

Mining and minerals:

- Students will participate in a hands-on lab to help them visualize and understand the process of extracting copper from ore

Rocks: (Supporting Standard)

- 8.P1U1.2 – Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties.
- Learning target 1 - Identify Unique Properties of Substances
- Learning Target 2 - Analyze Scientific Methods of Identification
- Learning Target 3 - Evaluate the Reliability of Identification Techniques

Butterfly

- *8.P4U2.5 – Develop a solution to increase efficiency when transferring energy from one source to another.*

Engagement Activity

Virtual Mining and Molecular Conservation: A Technology-Enhanced Science Experience

Teacher-Student Interactive Script

Teacher: "Welcome, future scientists! Today we're going on a digital mining expedition using AI and robotics to understand how atoms combine and rearrange in chemical reactions. Everyone, please put on your VR headsets."
Students: [Put on VR headsets]
Teacher: "You should now see a virtual mining site. Notice the geological formations containing different minerals. Your AI mining robot assistant is waiting for your commands."
Student 1: "I see crystalline structures in the rock face!"
Teacher: "Excellent observation! Using your controller, direct your mining robot to extract a sample from that formation. The AI will analyze its chemical composition."
[Students operate virtual mining robots]
Teacher: "As your robots collect samples, the AI is identifying the molecular structures. Look at your digital displays – what elements do you see?"
Student 2: "My sample shows copper and sulfur atoms forming copper sulfide!"
Teacher: "Perfect! Now, watch closely as we initiate a chemical reaction. The AI will show you the molecular visualization."
[Digital simulation displays molecular transformation]
Student 3: "The atoms are moving and connecting differently!"
Teacher: "That's right! Even though they're rearranging, count the atoms before and after. What do you notice?"

Student 4: "The number of atoms stays the same – they're just bonded differently now!"
Teacher: "Exactly! This demonstrates conservation of matter. Let's use the AI modeling tool to try different combinations. Remember, no matter how we rearrange these atoms, the total number of each type remains constant."
[Students experiment with molecular modeling.]
Teacher: "As you continue exploring, think about how this technology helps real mining operations. The same principles we're learning about atomic conservation apply whether we're in a lab or using robots to extract minerals."
Student 5: "This is like playing a video game, but we're learning real chemistry!"
Teacher: "That's the power of combining science with technology. Your robots are using AI to analyze chemical compositions just like real mining operations, while helping us understand fundamental chemistry principles."
[Class continues experimenting with virtual molecular structures.]
Note: This script demonstrates the integration of technology with standard chemistry concepts, making abstract ideas more concrete through visualization and interaction. Adjust the complexity of molecular structures and reactions based on student comprehension levels.
Student Investigation Procedure:

Virtual Mining Investigation: Exploring Chemical Reactions and Conservation of Matter

Safety Note: Always follow proper lab safety procedures and wear appropriate safety equipment.
Materials Needed:

- Computer or tablet with internet access
- Virtual mining simulation software
- Student investigation worksheet
- Calculator
- Periodic table

Investigation Procedure:

1. **Pre-Investigation**
   - Record your initial hypothesis about how atoms are conserved during chemical reactions
   - Review the periodic table and identify the elements you'll be working with
   - Log into the virtual mining simulation
2. **Virtual Mining Exploration**
   - Navigate to the mining simulation environment
   - Select your mining tools and safety equipment
   - Begin extracting virtual mineral samples
   - Document the chemical composition of each mineral found
3. **Chemical Analysis**
   - For each mineral sample:
     - Record the number and types of atoms present
     - Write the chemical formula
     - Draw a molecular model showing atomic arrangement

4. **Chemical Reaction Investigation**
    - Combine two mineral samples in the virtual lab
    - Observe and record any changes
    - Write balanced chemical equations
    - Count atoms before and after the reaction
    - Compare the number of atoms on both sides
5. **Data Collection**
    - Create a data table showing:
        - Initial compounds
        - Final compounds
        - Number of each type of atom before reaction
        - Number of each type of atom after reaction
6. **Analysis Questions**
    - How did the number of atoms change during the reaction?
    - What evidence supports the conservation of matter?
    - How do the molecular models help explain conservation?
    - What patterns did you observe in the chemical reactions?
7. **Conclusion**
    - Explain how your findings support or challenge your initial hypothesis
    - Describe how atoms are conserved in chemical reactions
    - Connect your findings to real-world chemical processes

Extension:
Create a diagram showing how atoms are rearranged but conserved during one of your observed reactions. Use Canva for diagram creation.
Link: canva.com

Day 1 :	Day 2:	Day 3:
8.P1U1.1 **Quick write activity** *8.P4U2.5 – Develop a solution to increase efficiency when transferring energy from one source to another.* ● **Learning Target 1 -** Explain the Law of Conservation of Mass **Mining and minerals:** Students will explore how mining processes involve chemical reactions that rearrange atoms to extract valuable minerals while maintaining the principle of atom conservation. **Task / Activity: Use AR/Merge cube to see the various minerals of a rock**	**8.P1U1.1** ● ***Learning Target 1 -** Explain the Law of Conservation of Mass* ● *Students will be able to explain how copper is purified by electrolysis* **Engagement:** ● Exploring ● Everyday Examples ● Student led Activity Task/Activity Student - led activity Student will show presentation using the powerpoint presentation or slides using google slides to present an everyday example of some minerals found at home.	**8.P1U1.1** ● **Learning Target 1 -** Explain the Law of Conservation of Mass **Task/Activity:** ● Interactive Demonstration – Ice Melting & Water Evaporation ● **Student's Activity:** *Measurement of mass* *Students generate report through taking measurements using weighing scale.* *Task/Activity:* *Teacher will introduce tinkercad for making an interactive ice melting using shapes and taking measurements.*

Teacher explain Mining, Extraction, and Purification (link: digintomining.com) Dig Into Mining: Metals In Your Everyday Life **Activity: Worksheet link:** untitled **Assessment:** Using flipanim.com, animate how mining extraction and purification is done. Link: www.flipanim.com **Day 4:** **8.P1U1.1** ● **Learning Target 1 -** Explain the Law of Conservation of Mass **Task/Activity:** ● Discuss how phase changes don't affect the amount of matter, only its form. Activity: Hands – on activity Minecraft activity – Integration of cultural aspects like mass of land and water. Task: The teacher will introduce Minecraft Education and allow the kids to navigate the various tools for crafting their design to build a pond or lake and mountains. Assessment: The finished output must be done within 10 days, with a video presentation and narration of the output done. The student will be able to present an output via powerpoint presentation or canva presentation. Link: www.canva.com Supporting apps: Slowmotion Capcut (short reels)	Link: www.googleslides.com Teacher explain the ways to create a slide in the powerpoint presentation. Including picture attachment and layouting setup. Students should have a background knowledge prior to presentation of the final output in class. Assessment: Power point presentation using canva or www.googleslides.com **Day 5:** **8.P1U1.2** Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties. ● Learning target 1 - Identify unique properties of substances Task/Activity: **Quick write** **Activity – Mystery Substance Investigation** Activity: Students will be able to distinguish the physical and chemical properties of minerals such us copper, magnesium and calcium using the merge cube or VR. Task: Teacher will be able to discuss the properties of the minerals. Discuss the proper way of using the merge cube and digital etiquette when performing tasks via online for the research. Assessment: Using sciencebuddies.com, answer in multiple choice or essay type the questions related to minerals. Supporting assessment apps:	*Link: www.tinkercad.com* Assessment: Create a layout demonstrating an interactive ice melting using shapes and its measurements using tinkercad. Some students may use animation to present the process of melting ice. Link: www.flipanim.com **Day 6:** **8.P1U1.2** Obtain and evaluate information regarding how scientists identify substances based on unique physical and chemical properties. ● Learning target 1 - Identify unique properties of substances Task/Activity: *Analysis:* Analyze methods used in real-world applications like forensic science, food quality testing, and environmental studies. Class discussion about forensic science and career related jobs. Activity: The students will be able to use the magnetic lens to check the fingerprints of the classmates. They may also use a camera or take pictures from a phone to gather data. Present how fingerprints relate to fossils and artifacts taken from the ground. Discuss evidence that shows the timeline of the artifacts. Connect the project to the Apache Cultural Center.

Follow the rubrics for grading	www.quizzis.com or www.kahoot.com	Assessment: How did the Apache people preserve artifacts? Why are they important? How does forensic science deals with the collection of artifacts and its role to the crime scene? Link: www.quizziz.com
Day 7 **8.P1U1.1 –** Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. **Learning Target 2-** Analyze Chemical Equations **Task/Activity:** *How many molecules of water are produced when 4 molecules of hydrogen gas react with 2 molecules of oxygen gas?* ***Quick write*** ***Activity: Study chemical elements and discuss*** ***Teaching strategy: Visual Representations****—Use molecular models, diagrams, or animations to show how atoms rearrange during reactions.* *Assessment: How do Apache people analyze the water reaction when it is mixed with the other extracted juices from sumac berries?* ***Link: 3d Merge Cube*** ***www.flipanim.com***	Day 8 8.P1U1.1 – Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. Learning Target 2- Analyze Chemical Equations Task/Activity: Scaffolding technique: Scaffolded Learning—Start with simple equations and gradually introduce more complex ones, reinforcing the Law of Conservation of Mass. Activity: Balancing Equations Relay Race—Students work in teams to balance equations as quickly and accurately as possible. Assessment: Cultural connection. What are various events in the Apache community that use horses for racing? How do they honor their land using the domesticated animals for gaming or racing? Link: www.khancademy.com	Day 9 8.P1U1.1 – Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. Learning Target 2- Analyze Chemical Equations Task/Activity: Digital Simulations—Use interactive online tools to manipulate chemical equations and observe mass conservation in action. Activity: PBL (Project-Based Learning) Create a puzzle or maze project Create a puzzle-based activity where students must balance equations to "unlock" the next clue. Teacher: Using the tinkercad, create a puzzle or maze. Assessment: Print via the .stl version for 3d printing and use marble to unlock the clue using the balance equations. www.tinkercad.com
Day 10 **8.P1U1.1 –** Develop and use a model to demonstrate that atoms and molecules can be combined or	**Day 11** **8.P1U1.1 –** Develop and use a model to demonstrate that atoms and molecules can be combined or	**Day 12** **8.P1U1.1 –** Develop and use a model to demonstrate that atoms and molecules can be combined or

rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. **Learning Target 3-** Construct and Interpret Molecular Models Task/Activity: ***Guided Inquiry*** *– Have students explore real-world chemical reactions and determine how equations represent them.* **Activity:** ***Gumdrop & Toothpick Models*** *– Students build molecular models to visualize reactants and products before balancing equations.*	rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. **Learning Target 3-** Construct and Interpret Molecular Models Task/Activity: ***Inquiry-Based Learning*** • *Have students* ***predict molecular shapes*** *before constructing models.* • *Guide them to compare their predictions with actual molecular structures.* *Activity: Hands – on building model building* • *Use* ***ball-and-stick molecular model kits*** *to help students visualize atomic structures and bonding.*	rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. **Learning Target 3-** Construct and Interpret Molecular Models Task/Activity: • *Use* ***balloons or clay*** *to represent electron pairs and molecular shapes.* • *Demonstrate* ***VSEPR theory*** *by arranging balloons to show different molecular geometries.* *Activity: Hands – on building model building* • *Use* ***ball-and-stick molecular model kits*** *to help students visualize atomic structures and bonding.*
Day 13 **Scientific process** **8.P1U1.1 –** Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. Task/Activity: Note-taking activity Discussion Question: ***"Why is it important for scientists to follow a structured process when conducting experiments? Can you think of examples where skipping steps might lead to incorrect conclusions?" This question encourages students to reflect on the importance of careful observation, hypothesis testing, and data analysis.***	**Day 14** **Scientific process** **8.P1U1.1 –** Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved. Task/Activity: Hands-on experiment Activity – Mystery Box Experiment ***Objective:*** *Teach students how scientists make observations, form hypotheses, and test predictions. This activity reinforces the* ***importance of observation, inference, and testing hypotheses****— key components of the scientific process.*	**Day 15** **Summative test** Describe the Law of Conservation of Mass in a chemical reaction. Explain your answer and cite at least 2 resources for your research citation.

<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>Extension:</td><td colspan="2">8.P4U2.5 – Develop a solution to increase efficiency when transferring energy from one source to another.
Link: https://claude.ai/public/artifacts/08b2b565-30b5-42b2-a25d-548cc1da07f1
Resources: Layout 1</td></tr>
</table>

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Appendices

Mining and Minerals: Chemical Reactions and Atom Conservation

8th Grade Science—Week-Long Lesson Plan

Maydafe Clark

AZ Standard:

8.P1U1.1 – Develop and use a model to demonstrate that atoms and molecules can be combined or rearranged in chemical reactions to form new compounds with the total number of each type of atom conserved.

Essential Question:

How do chemical reactions in mining processes demonstrate the conservation of atoms when minerals are extracted and processed?

Learning Target:

Students will explore how mining processes involve chemical reactions that rearrange atoms to extract valuable minerals while maintaining the principle of atom conservation.

Day 1: Introduction to Mining and Chemical Reactions

Learning Objectives:

- Identify common minerals and their chemical compositions
- Recognize that mining involves chemical processes
- Understand basic atom conservation principles

Materials:

- Mineral samples (pyrite, hematite, malachite, galena)
- Chemical formula cards
- Digital balance
- Magnifying glasses
- Mining process videos

Teaching Strategies by Learning Level:

Advanced Learners:

- Strategy: Independent research and analysis
- Activity: Research a specific mining operation and identify 3 chemical reactions involved, predicting products using chemical formulas

Grade-Level Learners:

- Strategy: Guided discovery with structured worksheets
- Activity: Examine mineral samples and match them to chemical formulas using provided reference sheets

Struggling Learners:

- Strategy: Concrete manipulatives and visual supports
- Activity: Use physical atom models to build simple mineral formulas with teacher guidance

Main Activities:

Opening (15 minutes):

- Hook: Show images of before/after mining sites and ask "What happened to the rock?"
- Vocabulary Preview: mineral, ore, chemical reaction, atom conservation

Exploration (25 minutes):

- Mineral Investigation Station:
  - Students observe and record properties of 4 mineral samples
  - Advanced: Calculate theoretical vs. actual mass percentages
  - Grade-level: Identify elements present using formula cards
  - Struggling: Match minerals to simplified picture formulas

Closure (10 minutes):

- Quick-write: "How might atoms rearrange when we extract copper from copper ore?"

Assessment:

- Formative: Exit ticket with one chemical formula and atom count
- Differentiated: Visual learners draw atomic arrangements, verbal learners explain to a partner

Day 2: Rubric for Powerpoint presentation

Everyday Minerals Presentation Rubric

Student Name: _________________ Date: _________________ Grade: _______

Scoring Scale

- 4 - Excellent (90-100%): Exceeds expectations
- 3 - Proficient (80-89%): Meets expectations
- 2 - Developing (70-79%): Approaching expectations
- 1 - Beginning (60-69%): Below expectations

Content Knowledge (40 points)

Mineral Identification & Properties (15 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Accurately identifies mineral and provides comprehensive details about physical properties (color, hardness, luster, crystal structure, streak)	Identifies mineral correctly with most physical properties accurately described	Identifies mineral with some physical properties described, minor inaccuracies	Mineral identification unclear or incorrect, few properties mentioned

Everyday Applications (15 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Provides multiple, detailed examples of how the mineral is used in daily life with clear explanations of why these properties make it useful	Provides several clear examples of everyday uses with good explanations	Provides some examples of everyday uses with basic explanations	Few or unclear examples of everyday applications

Scientific Accuracy (10 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
All scientific information is accurate, uses proper terminology consistently	Most scientific information accurate, uses appropriate terminology	Generally accurate with minor errors, some appropriate terminology	Several inaccuracies, limited use of scientific terminology

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Presentation Skills (30 points)

Organization & Structure (10 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Clear introduction, logical flow of ideas, smooth transitions, strong conclusion	Good organization with clear beginning, middle, and end	Generally organized but may lack smooth transitions	Poor organization, difficult to follow

Delivery & Communication (10 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Speaks clearly, maintains eye contact, confident posture, appropriate volume and pace	Good speaking skills, mostly clear delivery	Generally clear but may mumble or speak too fast/slow	Difficult to understand, poor eye contact, very quiet or too loud

Time Management (10 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Presentation is within time limit (5-7 minutes) with excellent pacing	Presentation close to time limit with good pacing	Slightly over/under time limit, adequate pacing	Significantly over/under time limit, poor pacing

Visual Aids & Technology (20 points)

Visual Design & Quality (10 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Visually appealing, high-quality images/graphics, clear fonts, good color choices, professional appearance	Good visual design, clear images, readable fonts	Adequate visual design, some unclear images or text	Poor visual design, unclear images, hard to read

Content Support & Integration (10 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Visual aids strongly enhance understanding, perfectly complement spoken content, creative use of technology	Visual aids support content well, good integration with presentation	Visual aids somewhat support content, adequate integration	Visual aids don't enhance presentation or are poorly integrated

Research & Sources (10 points)

Quality & Credibility of Sources (5 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Uses multiple credible, scientific sources (educational websites, scientific journals, textbooks)	Uses several credible sources with good variety	Uses some credible sources, limited variety	Few sources or questionable credibility

Citation & Bibliography (5 points)

4 - Excellent	3 - Proficient	2 - Developing	1 - Beginning
Properly cites all sources during presentation and provides complete bibliography	Cites most sources, good bibliography	Some citation during presentation, adequate bibliography	Little to no citation, incomplete bibliography

Total Score: _____ / 100

Grade Breakdown:

- A (90-100 points): Excellent work
- B (80-89 points): Proficient work
- C (70-79 points): Developing work
- D (60-69 points): Beginning work
- F (Below 60 points): Needs significant improvement

Teacher Comments:

Strengths:
Areas for Improvement:
Suggestions for Future Presentations:

Student Self-Reflection Questions:

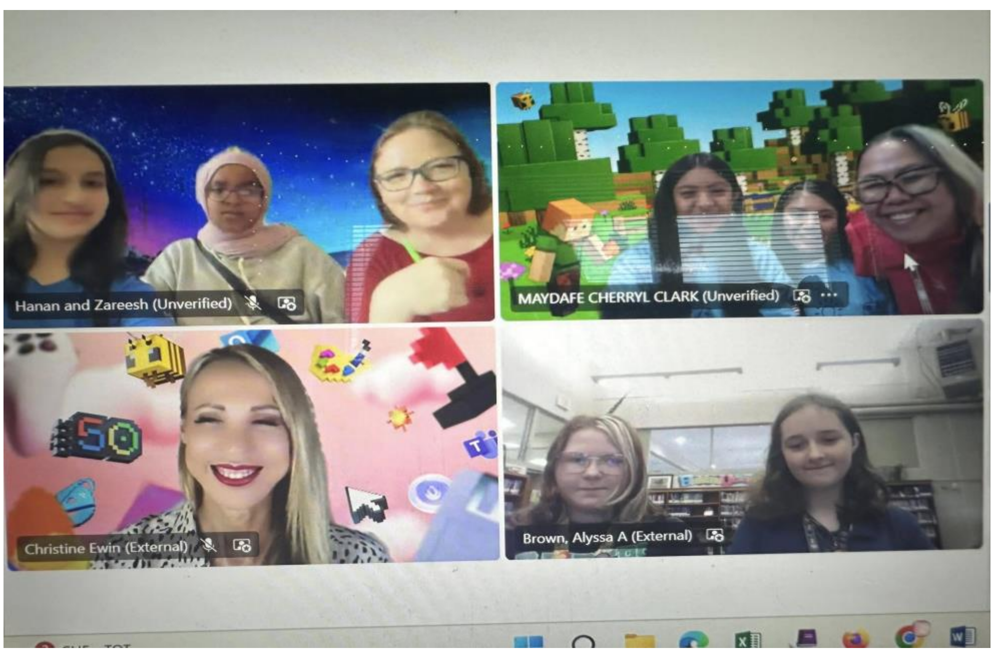
1. What was the most interesting thing you learned about your mineral?
2. What part of your presentation are you most proud of?
3. What would you do differently next time?
4. How do you think this mineral impacts your daily life?

Teacher Signature: _________________ Date: _________________

PHOTOS and video links:

Robotics Team of San Carlos Middle School during their first competition in FLL (First Lego League)

Girls Who Game Team - Minecraft Education in SCMS won Honorable mention for 2024 International Competition



Students gained a powerful boost in confidence as they took center stage as invited Masters of Ceremony, leading the presentation of their Minecraft build showcases with poise and pride.

Animation: