Culturally Responsive Schooling Within Indigenous Communities

Modeling Our Heritage: 3D Printing with Purpose

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Author Note:

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Topic and Context

Curriculum Overview

The curriculum unit **"** Modeling Our Heritage: 3D Printing with Purpose **"** is designed for junior high school students in the Talented and Gifted (TAG) program. This unit will be implemented throughout the month of November 2025, aligning intentionally with Native American Heritage Month to deepen students' cultural exploration through meaningful, hands-on experiences.

This unit bridges modern technology and Indigenous identity by introducing students to the fundamentals of 3D design and printing. Through guided lessons and collaborative activities, students will explore how digital tools that can be used to preserve traditional knowledge, express cultural narratives, and solve real-world challenges within their own community. From identifying culturally significant objects to designing and printing their own 3D models, students will engage in a process that is both technical and personally meaningful.

The unit not only emphasizes academic and creative growth but also affirms the importance of Apache heritage. Students will gain critical thinking and purposeful design skills, blending the past with the future to tell stories, solve problems, and reflect on what it means to be both Indigenous and innovative. Through research, discussion, prototyping, and presentation, learners will become active participants in shaping how technology can serve and inspire their community.

Aligned with Arizona state standards in technology, visual arts, writing, and social studies, this curriculum also centers culturally responsive teaching practices. Each lesson is rooted in students' lived experiences and cultural backgrounds, creating a space where learning is authentic, empowering, and grounded in community values.

Dishchii'bikoh Community School
Dishchii'bikoh Community School is a K-12 Title I grant-funded institution that has received primary support from the Bureau of Indian Affairs since 1991. It operates as a 501(c)(3) nonprofit organization under the governance of the Cibecue Community Education Board, Inc. Committed to fostering academic achievement while preserving the Apache language and cultural heritage. The school was founded to serve the children and families of Cibecue and neighboring communities within the White Mountain Apache Reservation (School Profile, n.d.).

Dishchii'bikoh Community School is more than an academic institution; it is a vibrant space where culture, language, and learning intersect to nurture the future of Apache youth. Situated just southwest of Cibecue's central area in Arizona, the school serves approximately 400 students, primarily Native American, along with a small number of Asian students. These learners range from Pre-Kindergarten (starting at age 4) through Grade 12. Most students are proud members of the Apache tribe, with an estimated 90% fluent in their native Apache language, highlighting the deep cultural heritage that shapes everyday life on campus (General Information, n.d.).

The academic year begins in late July and concludes in May, following the school calendar adopted by the community. Since 1991, Dishchii'bikoh has operated as a Bureau of Indian Affairs (BIA) grant school. It is governed by a six-member school board, elected by the parents

of enrolled Native American students, reinforcing the strong foundation of family involvement and community leadership (General Information, n.d.).

Previously named Cibecue Community School, the transition to Dishchii'bikoh, a name that reflects the Apache language, was a thoughtful and symbolic change, emphasizing the school's mission to honor and preserve the cultural identity of its students and families (General Information, n.d.).

With a dedicated team of approximately 103 staff members, the school provides four distinct educational programs: early childhood, elementary, junior high school, and high school. All are located together on a single, unified campus on the outskirts of Cibecue. Within this close-knit learning environment, students not only engage in core subjects like math, science, English, and social studies but also deepen their understanding of their heritage and build a strong sense of cultural pride (General Information, n.d.).

At the heart of Dishchii'bikoh Community School is a mission that embraces every student's potential: "For Everyone, A Way to Learn, Grow, and Succeed." This guiding principle shapes everything the school does, ensuring that education is both inclusive and empowering. Rooted in a deep partnership with students, families, and the broader community, the school is dedicated to cultivating academic excellence. More than just a place of learning, Dishchii'bikoh Community School fosters an environment that honors and upholds the language and cultural traditions of the Apache people. Tribal values are not only respected but they are actively used to deepen students' understanding of their identity and to inspire pride in their heritage (Mission & Philosophy, n.d.).

Through this culturally grounded approach, the school provides meaningful opportunities for students to grow in all areas of life, including intellectually, emotionally, socially, and physically. Ultimately, the school aims to help students succeed personally and academically, while also preparing them to make positive contributions to both their tribal community and the larger world (Mission & Philosophy, n.d.).

The Cibecue Community

Cibecue is a small, rural community nestled in the high mountain desert of the American Southwest. Surrounded by rolling hills, tall trees, and native desert flora and fauna, it offers a quiet, natural environment far from the noise of urban life. Located about 50 miles from the nearest commercial hubs like Show Low, Globe, and Whiteriver. Cibecue feels remote but remains within reach of basic amenities (FAQ, n.d.). Whiteriver, the main headquarters of the White Mountain Apache Tribe, on the Fort Apache Indian Reservation. As of the 2010 Census, the community had around 1,700 enrolled tribal members (Cibecue Community, n.d.).

The community sits on the White Mountain Apache Reservation, which means there are tribal land restrictions that influence who can live there. Most non-tribal school staff live in Show Low and commute daily. Fortunately, Dishchii'bikoh Community School provides shuttle services to and from Show Low and Whiteriver, and a few campus housing units are available for staff (FAQ, n.d.).

Weather in Cibecue is generally mild. Summers are warm but far less intense than those in Phoenix, while winters are cold and sometimes drop below freezing. Homes are typically heated

with propane, electricity, or wood, and most residents use window air conditioners in the summer due to the dry, semi-arid climate (FAQ, n.d.).

The community itself is made up mostly of single-family homes and small family farms or ranches. Essential services such as an Indian Health Services (IHS) Clinic, Head Start preschool, tribal offices, a housing authority, an ambulance and fire station, and a few churches support daily life in the area. Medical care is available through a local IHS clinic for Native American residents, while non-tribal members must travel to Show Low for treatment. Full-service EMTs and an ambulance facility are located in town, and the school also has a nurse on staff. The nearest full hospitals are in Show Low and Whiteriver, each about an hour away. Phoenix, the closest major city, is about a three-hour drive south (FAQ, n.d.).

Several tribal-run businesses and facilities operate in Cibecue, including a Commercial Center, gas station, tire shop, and the Cibecue Complex, which houses tribal programs and a police sub-station. Mail services are handled through a post office drop station, with deliveries routed through the Show Low Post Office (Cibecue Community, n.d.).

Cibecue has a moderate level of connectivity. While satellite solutions may be available depending on the provider, such as Frontier Communications is the primary supplier for DSL internet and telephone service, as well as CellularOne. DirecTV and Dish Network both offer satellite television. CellularOne and AT&T offer dependable cellular service; some people utilize the T-Mobile network, but their internet data is limited and they must use roaming, while Verizon is out of coverage (FAQ, n.d.).
While shopping options in Cibecue are limited to basic needs, residents rely on nearby towns like Show Low and Whiteriver for more extensive retail choices, including stores like Walmart, Safeway, and various hardware shops and small businesses. UPS, FedEx, and USPS all deliver to the area. For lodging, visitors typically stay in Show Low, which also features the nearest regional airport. Sky Harbor International Airport in Phoenix is the closest major air travel hub (FAQ, n.d.).

Cibecue may be small and remote, but its strength lies in its strong sense of community, connection to nature, and deep cultural heritage. It is a place where daily life is rooted in tradition, and simplicity offers its own kind of richness (FAQ, n.d.).

My Students and Talented and Gifted (TAG)

This curriculum unit, designed for the junior high school Talented and Gifted (TAG) students at Dishchii'bikoh Community School, focuses on integrating 3D design and printing to empower students through culturally relevant, technology-driven learning. The project will be implemented during Native American Heritage Month in November 2025. Students will engage in meaningful and hands-on learning.

TAG students at Dishchii'bikoh are advanced learners with high potential in creative, analytical, and technological domains. These students benefit from enriched, challenging, and culturally relevant experiences that align with their intellectual abilities and cultural identities. Situated on the White Mountain Apache Reservation in Cibecue, Arizona, Dishchii'bikoh Community School serves students who are deeply connected to their heritage, history, and environment.

This curriculum unit serves as an interdisciplinary project bridging technology, art, history, and community involvement. The unit fits naturally within the school's broader mission to foster cultural pride while promoting 21st-century skills. November, designated as Native American Heritage Month, provides an ideal context for exploring how Indigenous communities can harness modern tools like 3D printing to preserve, innovate, and communicate cultural knowledge.

Over the course of the month, students will learn basic 3D design principles, explore community needs, and historical narratives, and produce culturally significant artifacts. Projects may include traditional tools, jewelry, symbolic artwork, or architectural models. Students will develop their ideas using free software such as Tinkercad and bring their visions to life with classroom 3D printers.

Rationale

As an educator with over two decades of experience, my journey in the classroom began in 1999. I have spent the majority of my professional life dedicated to teaching, evolving alongside my students and the technologies that shape our world. For 17 years, I taught computer science courses at the college level, nurturing the technical skills of young adults while challenging them to think critically and solve real-world problems. Later, I transitioned into teaching information technology and math in public schools, where I spent two and a half years adapting my instruction to suit a different student demographic with diverse learning needs. Eventually, I moved to the United States, and for the past seven years, I have had the privilege of working with middle and high school students in the Talented and Gifted (TAG) program at Dishchii'bikoh Community School.

Throughout my career, I have continually sought out ways to integrate technology meaningfully into the curriculum. Whether through interactive simulations, programming challenges, or project-based learning using digital tools, I have always believed that technology, when used thoughtfully, can create powerful learning experiences. My academic background, which includes a bachelor's degree in computer science and master's degrees in information technology, Management, and Education, has provided me with a strong foundation in instructional design and technical expertise. Currently, as I pursue my Doctor of Philosophy in Educational Leadership and Management, I continue to deepen my understanding of how education can serve as a transformative force, not just for individuals, but for communities.

That said, I am fully aware of the limitations of my own lived experiences. While I bring a wealth of knowledge in technology and pedagogy, I do not come from an Indigenous background. I do not speak the Apache language, and I did not grow up immersed in the cultural practices or traditions of the White Mountain Apache Tribe. This awareness is central to my approach in developing this curriculum unit. Rather than pretending to have all the answers, I choose to enter this work with humility. I view myself not as the sole expert in the room, but as a facilitator and co-learner. I believe that real cultural authenticity and relevance cannot come from outside assumptions or textbooks, but rather, it must come from within the community itself.

This perspective shapes how I engage with my students, their families, elders, and the broader community. I see them not only as learners, but as co-educators and cultural consultants. Their voices, stories, and lived knowledge are essential in shaping lessons that are not only educational, but meaningful and respectful of the culture we aim to preserve and celebrate.

I designed this unit because 3D design sits at a powerful intersection of technology and culture. In our classrooms, students are constantly asked to consume media and products made by others. This unit invites them to become makers who plan, model, print, and present artifacts that speak to identity, place, and responsibility. 3D design is not only a technical skill set (CAD, slicing, accurate measurements) but also a literacy, a way of communicating ideas, values, and histories in tangible form.

This topic is especially meaningful for students in the middle grades (6–8). At this stage, they are ready to move from simply asking how to use a tool to thinking about what purpose it serves. They are eager to explore questions of identity, community, and ethics. 3D design channels that curiosity by encouraging students to plan carefully, make decisions within real constraints, and revise their work based on feedback for innovative and creative communication. At the same time, they come to understand that technology carries social and cultural impacts. A printed keychain may seem simple, but a printed story or a symbol that honors family teachings, or even a small replacement part that repairs a well-used classroom item, encourages students to think about who benefits from technology and how their choices uphold the Diné values of *hózhó* (balance and harmony) and *K'é* (kinship, cooperation, and responsibility).

The unit connects meaningfully to students' cultures, families, communities, and histories by presenting technology as a tool for serving people and place. Learners explore cultural symbols and artifacts not as museum objects but as living knowledge passed down through oral histories, daily practices, and guidance from community mentors. Students are encouraged to interview family members or elders, observe how objects are used and what they represent, and thoughtfully decide what is appropriate to study, model, or recreate. This approach emphasizes that not everything should be reproduced and that permissions, recognition, and respectful representation are essential. When 3D design is framed around preservation, repair, and storytelling, the work becomes purposeful and honorable, whether students are designing a replacement bead loom part for a community workshop, creating a model that illustrates a clan story, or building a stand to display a cultural object in class. Each of these projects encourages students to ask how their skills can be used to support and strengthen their community.

The unit follows the principles of the Culturally Responsive Assessment of Indigenous Schooling (CRAIS) by emphasizing student voice, community relevance, and different ways of learning. Rather than relying on one final test, it views learning as something that can be seen and reflected on over time through activities such as sticky note reflections, talking circles, See Think Wonder charts, design checkpoints, feedback exchanges, and journals. Assessment includes conversation, demonstration, and reflection along with the printed designs and digital files. This approach values students as holders of knowledge and recognizes that learning grows through relationships. The design process, moving from brainstorming and research to modeling, feedback, revision, printing, and presentation, reflects real practices in both engineering and art. The TAG method (Tell, Ask, Give) encourages a culture of respectful feedback, connecting the process to *hózhó* and *K'é*. Through this, students learn humility, responsibility, and cooperation

as they respond to peer feedback, improve their work, and acknowledge sources of cultural knowledge.

The unit also serves a practical academic purpose. It integrates Visual Arts through idea generation, refinement, and presentation, Computer Science through the study of computing impacts and artifact creation, Social Studies through civics and culture, and English Language Arts through speaking, listening, and reflective writing. It supports multilingual and multimodal learners by recognizing oral storytelling, visual analysis, hands-on creation, and digital design as valid forms of expression. Students who excel in drawing or building have opportunities to lead, while those strong in research or speaking can showcase their skills during presentations. Because the final products are real, such as STL and G code files or printed models, students develop accountability for precision and file management, understand what measurement accuracy mean when parts must fit, and see how revising and refining improve both function and meaning.

I enter this work as an educator who values making and storytelling. My funds of knowledge include classroom experience designing interdisciplinary projects, coaching students through iterative problem-solving, and facilitating peer feedback that is specific, kind, and useful. I am comfortable with 3D design tools (e.g., Tinkercad, slicing software) and with creating authentic assessments that collect evidence of growth over time. I also bring ongoing learning in culturally responsive practice, especially in honoring student and family knowledge as primary sources and in designing activities that foreground relationship, responsibility, and relevance.

At the same time, I recognize my limitations. I am not the sole authority on local cultural practices, histories, or languages, and there are situations involving ceremonies, sacred knowledge, or clan teachings where decisions about representation and reproduction should come from the community itself. To grow in these areas, I rely on students and families as co-teachers, invite elders or cultural leaders to share their perspectives when appropriate, and include consent and permission steps in research activities. When students choose objects that might be sensitive or restricted, we pause to discuss alternatives, such as symbolic versions or explanatory models that still convey meaning without crossing boundaries. This collaborative approach supports culturally sustaining and responsive practices. It helps students see their knowledge as valuable, helps families view the classroom as a place of respect, and allows me to keep learning, adapting, and improving the unit through ongoing dialogue with the community.

Many schools are creating makerspaces and using digital fabrication, but these experiences often focus more on novelty than purpose. This unit emphasizes that purpose should come from relationships and community meaning. It encourages students to think about how making can support cultural continuity, problem solving, and pride. For students, this becomes clear through their own projects, such as a model that represents a family teaching or a presentation that shares a story their classmates may not have heard before. In this regard, 3D design is not only preparation for future STEM learning but also an immediate way to care for people, objects, and places.

The unit is also built to be safe, ethical, and flexible. Students learn to make careful choices about what to design, when to seek guidance, how to give credit for cultural knowledge, and how to present their work respectfully. They practice versioning, reflection, and revision so that learning becomes a process of growth and responsibility. Assessment is clear and fair, helping

students understand what matters such as technical accuracy, originality, cultural meaning, and communication, and giving them multiple ways to show success.

In essence, the purpose of this curriculum is to help students see technology as a tool for belonging, allowing them to create with care, communicate with purpose, and act with respect. By combining Diné values, community wisdom, and strong design practices, the unit helps students become thoughtful creators and storytellers who can balance innovation with tradition and design meaningful artifacts that serve their community.

Instructional Guide

This unit introduces students to 3D design as both a technical discipline and a cultural practice. Students learn how digital modeling and 3D printing can support community purposes (preservation, repair, and storytelling) while embodying Diné values of *hózhó* and *K'é*. The unit weaves together foundational design skills (precision, planning, structure), ethical use of technology, and culturally responsive assessment so learners can create, iterate, print, and present original artifacts that honor identity and community (Castagno et al., 2023; Arizona Department of Education, 2022; Navajo Nation Department of Diné Education, n.d.).

Essential Background Ideas and Concepts

1. This unit begins with an introduction to 3D design foundations, helping students understand how digital models are created and prepared for printing. They learn the basics of computer-aided design (CAD) such as how to create objects using simple shapes, resize and align them, and group elements to form complete designs. Students also learn the importance of precise measurements, consistent design, and version control while following the complete 3D printing workflow from saving a model as an STL file and processing it through slicing software to generating G-code and producing the final physical print.
2. Students follow a design process that mirrors real-world engineering and creative workflows. They begin by brainstorming ideas, researching, and developing a model. After creating their first version, they receive TAG feedback (Tell/Ask/Give) from peers, which encourages constructive and respectful critique. They then revise their designs, prepare them for printing, and finally present their finished work to the class.
3. An important part of this unit is understanding ethics and cultural practices. Students learn that while technology allows for easy reproduction of objects, not every item should be recreated. They discuss issues such as cultural recognition**,** representation, and permissions, reflecting on how technology can be used thoughtfully and respectfully to uphold community values and traditions.
4. The lessons are grounded in Diné teachings and values, especially *Hózhó*, which represents balance, harmony, and beauty, and *K'é* and responsibility to others. These values guide how students design, collaborate, and reflect throughout the process (Navajo Nation Department of Diné Education, n.d.).
5. Finally, the unit recognizes multiple ways of knowing. Students are encouraged to see knowledge not only in written texts but also in oral histories, visual storytelling, community

interviews, and digital creation. This approach respects both Indigenous and modern perspectives on learning and making (Castagno et al., 2023).

Coherent Summary of Teaching Strategies, Lesson Sequence, and Assessments

- Lesson 1: Introduction to 3D Design sets the foundation with a sticky-note knowledge activation and video analysis, then a talking circle on community purposes (preservation, repair, storytelling). Teacher clarifies core modeling principles (precision, planning, structure) and connects technology with cultural care (Arizona Department of Education, 2019, 2022).
- Lesson 2: Understanding Culture and Artifacts deepens cultural literacy. Students define "culture," write personal reflections, and analyze Indigenous artifacts using See–Think–Wonder. They consider how artifacts carry values and histories and where 3D technology may respectfully assist preservation.
- Lesson 3: Intro to Tinkercad builds tool fluency through direct demonstration and a guided keychain task using resize/align/group/export, closing with a CRAIS "check for understanding." Students connect precision to *hózhó* and responsible making (Castagno et al., 2023).
- Lesson 4: Designing with Cultural Meaning moves into inquiry. Students select a meaningful symbol, conduct mini-research with both academic sources and community knowledge (e.g., interviews), and document origin, meaning, and use. Emphasis is on cultural practices, acknowledgement, and dignity in representation.
- Lesson 5: Design Refinement centers on feedback as students practice the TAG method, exchange peer critiques, and receive teacher coaching to revise their models (framing critique as a balanced, relational process aligned with *hózhó* and *K'é*) (Navajo Nation Department of Diné Education, n.d.).
- Lesson 6: 3D Printing & Presentation Preparation is the stage where students finalize their models, manage exports and slicing, and begin developing slide decks to communicate both the technical process and cultural meaning, demonstrating an Educational Technology Standard (ETS)-aligned creative communication outcome (Arizona Department of Education, 2022).
- Lesson 7: Presentations & Reflection centers student voice. Learners present printed objects and digital models, explain research and design choices, and reflect on learning in a closing circle. Peers offer respectful feedback. Students complete a reflective journal on identity, community, and technology's role in cultural continuity.

Assessment Plan

- Formative: Entry sticky-notes; talking-circle observations; See–Think–Wonder charts; skill demonstrations in Tinkercad; feedback sheets; exit tickets. Evidence emphasizes authentic, in-the-moment performance and qualitative notes (Castagno et al., 2023).
- Summative:
  - Design Artifact Portfolio: STL/G-code evidence and printed model assessed for technical accuracy, originality, and cultural reflection.
  - Research & Reflection Journal: Sources (including community voices), ethical considerations, and connections to *hózhó/K'é*.
  - Presentation: Clarity of cultural meaning, process explanation, and respectful communication, aligned to Visual Arts presentation standards (Arizona Department of

Education, 2015) and ETS Creative Communicator (Arizona Department of Education, 2022).

Culturally Responsive & Sustaining Practices

1. Student Voice & Agency (CRAIS): Talking circles, reflective journals, peer-led critique, and choice of culturally meaningful symbols foreground learners as knowledge holders. These are captured through observation logs and student artifacts as valid evidence of learning (Castagno et al., 2023).
2. Community Relevance (CRAIS): Research methods explicitly value family interviews, elder knowledge, and local examples; design problems center community needs (preservation/repair/storytelling), positioning technology as service to people and place (Castagno et al., 2023).
3. Multiple Ways of Knowing (CRAIS): The unit integrates oral storytelling, visual analysis, hands-on making, and digital design—equal in status to textbook sources. Assessment honors demonstration, dialogue, and reflection, not just written tests (Castagno et al., 2023).
4. Diné Standards Integration: Every lesson invites balanced, ethical practice (DCC.S1 *hózhó*) and interpretation of teachings through contemporary design (DCC.S2). Character standards emphasize humility, responsibility, and cooperative relationships (DCB.S1/S2/S3), while history standards connect artifacts and oral traditions to modern expression (DHS.S1/S2) (Navajo Nation Department of Diné Education, n.d.).
5. Standards Alignment (AZ ETS/CS/Visual Arts/ELA/SS): Students iterate as innovative designers, communicate with purpose, and evaluate media; they analyze cultural impacts of computing and present artistic work with meaning (Arizona Department of Education, 2015, 2018, 2019, 2022).

In summary, this unit guides students through a clear journey: they learn the basics of CAD, explore cultural meaning, create purposeful designs, improve their work through feedback, print their models, and share their reflections. Throughout the process, teaching and assessment remain culturally grounded, academically challenging, and focused on community connections.

Teaching Plan

Lesson 1: Introduction to 3D Design

Learning Objectives:

By the end of this lesson, students will be able to:

1. Define 3D design and describe its real-world applications in fields such as architecture, medicine, and cultural preservation.
2. Discuss how 3D printing can serve community purposes such as preservation, repair, and storytelling.
3. Demonstrate understanding of *hózhó* by reflecting on how technology can care for cultural objects, people, and places.
4. Explain key principles of 3D modeling which is precision, planning, and structure, and relate them to design accuracy.

5. Identify how Indigenous communities use 3D technology to preserve cultural heritage, demonstrating cultural awareness and respect.

Alignment to Standards:

- Arizona Educational Technology Standards (ETS) (Arizona Department of Education, 2022)
  - Strand 1: Creativity & Innovation (Concept: Knowledge & Ideas, Models & Simulations) Students analyze information, evaluate real-world cases, and explore digital modeling concepts using foundational analogies.
  - Strand 2: Communication & Collaboration - Students collaborate and share ideas using digital.
  - Strand 3: Research & Information Literacy (Concept: Processing) - Students evaluate and synthesize information from diverse sources.
  - Strand 4: Critical Thinking, Problem Solving & Decision Making (Concept: Exploring Solutions) - Students plan and manage solutions to challenges
- Arizona Computer Science Standards (Arizona Department of Education, 2019).
  - CS.D.01.02 - Describe how computing technologies influence cultures and societies.
  - CS.DD.02.01 - Use digital tools to design and create artifacts.
- Culturally Responsive Assessment of Indigenous Schooling (CRAIS) Framework (Castagno et al., 2023)
  - Student Voice and Agency: Instructional design ensures students are active participants, sharing personal and cultural knowledge, and making decisions in their learning process.
  - Community Relevance: Lessons connect technology and digital literacy to real-world Indigenous applications (preserving stories, repairing tools, or designing for community sustainability).
  - Multiple Ways of Knowing: The lesson integrates oral dialogue, visual design, reflection, and technical problem-solving as valid and complementary forms of learning and assessment.
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S2: Show respect, humility, and cooperation through shared learning and feedback.
    - DCB.S3: Reflect on self and community pride through shared experiences.
  - Diné Culture Standards:
    - DCC.S1: Demonstrate balance, harmony, and respect when engaging in creative and cultural learning.
    - DCC.S2: Identify, describe, and interpret cultural values and teachings through traditional and contemporary expressions such as digital art and 3D design.
  - Diné History Standards:
    - DHS.S1: Examine the importance of cultural artifacts and oral traditions to strengthen identity and cultural continuity.
    - DHS.S2: Connect traditional storytelling and craftsmanship to modern technological expression.

Instructional Strategies:

1. Activate prior knowledge: 3D Design Foundations
   - Begin the lesson by asking two guiding questions to the students:
     1. “What do you already know about 3D design?”

2. “Where have you seen 3D printing used in real life?”

- Distribute two color-coded sticky notes to each student:
  - Yellow for Question 1
  - Orange for Question 2
- Instruct students to write one idea or example per sticky note based on their own knowledge or experiences.
- Set up a large T-chart or labeled sections on the board/wall:
  - Left side: “What We Know about 3D Design”
  - Right side: “Real-World Uses of 3D Printing”
- Have students place their yellow sticky notes on the left side and orange sticky notes on the right.
- Once all responses are posted, facilitate a class discussion:
  - Group similar ideas or themes together.
  - Clarify misconceptions and highlight insightful or unique responses.

(The activity builds Student Voice and Agency by letting learners lead the discussion and express experiences, embracing Multiple Ways of Knowing through visual, oral, and collaborative sharing. This reinforces Diné hózhó by linking old and new knowledge, cultivates self and community pride, and highlights how design preserves cultural identity.)

2. Talking Circle: Community Purposes of 3D Design
   - Begin with a class circle where students discuss community purposes of 3D design in preservation, repair, and storytelling. In the circle, everyone has an equal chance to speak (Castagno et al., 2023).
   - Students will be asked to reflect on how 3D design and printing can be used to serve the community. For example:
     - Preservation: Recreating damaged cultural artifacts, tools, or heirlooms.
     - Repair: Designing replacement parts for community items, tools, or objects.
     - Storytelling: Using 3D models to represent stories, symbols, or values from their culture.
   - Students share examples or ideas, and their responses will be documented on the board or a class chart.

(The activity centers Community Relevance and Student Voice through dialogue, using relational sharing as a form of culturally responsive assessment. This reinforces Diné Connections by having students interpret cultural values, practice K'é (cooperation and respect), and link traditional craftsmanship and storytelling to modern technology.)

3. Visual Engagement: Real-World 3D Printing Applications
   - Begin by explaining that students will explore how 3D printing is transforming different fields including architecture, medicine, environmental design, and cultural preservation. Emphasize that the goal is not only to learn about the technology but also to reflect on how it can be used responsibly to maintain *hózhó* which is balance, harmony, and respect, in caring for people, communities, and cultural heritage.
   - View and Analyze the Video: Present a short, high-quality educational video highlighting real-world 3D printing applications (e.g., creating prosthetics for patients, printing sustainable housing, restoring museum artifacts, or reproducing Indigenous objects for learning).
   - Guided Discussion Prompts: Pause the video at meaningful moments to invite reflection and discussion using CRAIS principles of Student Voice and Agency. Encourage students to connect what they see to cultural values and real-world community needs.

(The activity integrates Multiple Ways of Knowing and builds Community Relevance by connecting global technology to local values. This reinforces Diné hózhó by balancing technology with culture, while challenging students to analyze how innovation can safeguard cultural heritage and maintain continuity with past craftsmanship.)

4. Direct Instruction: Key Concepts and Cultural Relevance
    - Explain the importance of precision, planning, and structure in digital modeling.
        - Use simple design analogies (e.g., building with LEGO bricks) to illustrate concepts like alignment and scale.
    - Cultural Relevance Emphasis:
        - Highlight how cultural institutions like museums and Indigenous communities use 3D scanning and printing to digitally preserve and share cultural heritage.
        - Present an example of a digitally replicated artifact and demonstrate the CRAIS principles of representation and accuracy by identifying the piece's origin, cultural protocol, and representation (Castagno et al., 2023).

    (The activity integrates Culturally Responsive Assessment by using ethical reasoning and reflection, boosting Student Voice and Multiple Ways of Knowing through critique. This reinforces Diné hózhó between creativity and cultural respect, instills humility and ethical responsibility, and explores the use of digital tools to preserve cultural history.)

Learning Resources:

- Sticky Notes (Yellow and Orange)
- Whiteboard for writing guiding questions, setting up the T-chart, and organizing student responses.
- Dry Erase Markers or markers for use on the whiteboard or chart during brainstorming and discussion.
- Projector or large display screen
- Educational video on 3D printing applications
- Images or 3D scans of cultural artifacts
- LEGO bricks
- Exit Ticket
- Reflection journals

Assessment:

Formative Assessment:

- Engagement Activity: Using color-coded sticky notes, students write individual responses that are then posted on a large T-chart.
    - This serves as a diagnostic tool to assess students' baseline understanding and identify common themes or misconceptions. During the class discussion, student participation and engagement will be observed. These observations will guide instructional adjustments and highlight areas where additional support or clarification may be needed.
- Talking Circle Participation: Observation checklist for inclusivity and evidence of voice and agency.
- Video Reflection Discussion:
    - Observation and Participation Log - The teacher observes and records student engagement during video pauses and discussions.
        - Focus areas include:
            - Active participation and respectful listening during discussion.

    - Ability to articulate cultural and community implications of 3D printing.
    - Contributions demonstrating Student Voice and Agency (CRAIS principle).
    - The teacher documents key insights on the board or a shared digital platform, highlighting responses showing understanding of cultural preservation and technological ethics.
- Direct Instruction: Students' understanding will be informally assessed through questioning and their ability to relate these abstract concepts to familiar analogies, such as building with LEGO bricks. Students' engagement and conceptual grasp by prompting them to explain the importance of accuracy in digital design and how cultural heritage can be preserved through 3D scanning and printing will be assessed.
- Exit Ticket: Ask students to write brief responses to the following prompts:
    - What is one benefit of using 3D design in the real world?
    - Why is planning and precision important when creating a 3D model?
    - How can 3D technology uphold *hózhó* in caring for cultural objects or places?

  (The activity captures Student Voice and Reflection as evidence of learning, reinforcing the Diné focus on mindfulness and accountability in creation.)

Summative Assessment:
- Reflection Journal (Homework):
    - What is one new thing you learned about 3D design or 3D printing that surprised or interested you?
    - Which example of 3D printing (from the video or discussion) did you find most interesting or meaningful, and why?
    - In your opinion, how can 3D technology help preserve culture or history? Give an example or idea.
    - How can 3D printing support *hózhó* in caring for cultural objects, people, and the environment?

  (The activity builds Student Voice and Agency through personal reflection, strengthening Community Relevance by linking digital innovation to cultural well-being. This integrates Multiple Ways of Knowing by requiring self-assessment across emotional and cultural lenses. It reinforces Diné Connections, demanding hózhó, the interpretation of cultural teachings in modern contexts, and the expression of cultural pride and the role of technology in cultural preservation.)

Lesson 2: Understanding Culture and Artifacts

Learning Objectives:

By the end of this lesson, students will be able to:
1. Define culture and explain its importance in preserving identity and community values.
2. Reflect on their own family traditions, cultural symbols, and personal heritage through written expression.
3. Identify and interpret features of traditional Indigenous artifacts using observation and inquiry.
4. Demonstrate respect (*hózhó*) and cultural awareness through collaboration and reflection.
5. Connect technology and design concepts (e.g., 3D printing) to cultural preservation and storytelling.

Alignment to Standards:
- Arizona Social Studies - Civics & Culture (Arizona Department of Education, 2018)

- SS08-S1C1-03: Demonstrate civic virtues that contribute to the common good and democratic principles in various settings, which supports respectful cultural discussion and artifact analysis.
- SS08-S1C2-01: Analyze how cultural perspectives influence social structures, traditions, and artifacts.
- SS08-S1C5-02: Explain how contributions from diverse cultural groups enrich local and national identity.

- Arizona English Language Arts (Arizona Department of Education, 2016)
  - SL.8.1: Engage effectively in collaborative discussions, building on others' ideas and expressing information clearly.
  - RI.8.7: Evaluate multiple media formats (e.g., artifact images, videos) for how they portray cultural ideas or structures.
  - W.8.4 / W.8.10: Produce coherent, focused writing for varied purposes; regularly write over extended and short time frames.
- Culturally Responsive Assessment of Indigenous Schooling (CRAIS) Tool (Castagno et al., 2023).
  - Student Voice and Agency: Students express their own cultural knowledge, stories, and observations as valid and valued sources of learning.
  - Community Relevance: Students connect classroom activities to local, familial, and Indigenous cultural contexts
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S2: Builds respect and cooperation through communal sharing and listening.
  - Diné Culture Standards:
    - DCC.S1: Demonstrate respect for self, others, and the environment by practicing *hózhó.*
    - DCC.S2: Identify and interpret Diné cultural teachings, values, and practices through traditional and contemporary expressions.
  - Diné History Standards:
    - DHS.S1: Encourages understanding of how objects, traditions, and oral histories sustain identity.

Instructional Strategies:

1. Initia**l** Brainstorming Session: Defining Culture
- Begin the lesson by writing the word "culture" on the board and asking the students: "What does culture mean to you?"
- Facilitate a brief brainstorming session where students contribute their ideas.
- Introduce a guiding question: "Why is it important to learn about our cultural heritage and traditions?"
- As students share, record their ideas on a visible class chart to honor diverse contributions.

(The activity builds Student Voice and Agency by validating students as cultural experts who share their lived experiences, which establishes Community Relevance. This action reinforces Diné Hózhó through respectful self-expression and builds K'é through communal listening.)

2. Individualized Reflective Learning: Exploring Cultural Identity
- Ask students to respond to the following reflection in writing:
  1. What are some traditions or celebrations your family takes part in?

2. Is there a cultural object (like clothing, jewelry, tools, or art) that has special meaning in your family?
3. Who in your family teaches you about your culture or background?
4. What part of your culture or background makes you feel proud?

- Encourage volunteers to share their reflections aloud. This activity amplifies Student Voice by validating each learner's cultural story while promoting Community Relevance through shared understanding.
- Document recurring cultural themes or values in a reflection log as evidence of student engagement, following CRAIS's recommendation for capturing qualitative insights (Castagno et al., 2023).

(The activity captures Student Voice and Agency by validating students' cultural stories as learning evidence, integrating Multiple Ways of Knowing through reflection and narrative. This reinforces Diné Standards by connecting objects and oral histories to the sustenance of identity and promoting reflection on shared cultural teachings and values.)

3. Cooperative Learning: Artifact Analysis through See-Think-Wonder
   - Instruct students to work in groups of two, using the See-Think-Wonder chart to record their observations:
     - *See:* What do you notice? (shapes, materials, patterns, colors)
     - *Think:* What do you think these items were used for or what they represent?
     - *Wonder:* What questions do you have about the culture or artifact?
   - Group Presentation:
     - Display artifacts visibly: Project the images clearly for ongoing reference.
     - Each group are invited to present their chart and shares insights with the class.
     - Facilitate discussion to prompt deeper thinking. Ask the following open ended questions:
       - What do these items tell us about the people who made and used them?
       - What values or skills do these artifacts reveal?
     - Use student-generated questions as formative data under CRAIS to assess critical thinking, cultural awareness, and engagement (Castagno et al., 2023).

(The activity builds Community Relevance and Multiple Ways of Knowing by having students analyze real cultural artifacts through observation and dialogue, using collaborative inquiry as a form of assessment. This reinforces Diné Standards by encouraging students to identify the cultural values in the artifacts, promote Hózhó by respecting their deeper meaning, and recognize how these objects carry cultural memory and historical significance.)

Learning Resources:

- Whiteboard for brainstorming and guiding questions
- Markers for recording student ideas
- Projected images of traditional Indigenous artifacts
- See-Think-Wonder chart templates
- Reflection journals for individualized responses and homework
- Projector or screen for displaying artifact images clearly
- Culturally relevant images of Indigenous artifacts (digital or printed)
- Online museum archives (e.g., Smithsonian NMAI, Navajo Nation Museum)
- Culturally relevant video clips on 3D printing, Indigenous heritage, or cultural preservation.

Assessment:

Formative Assessment:

- Initial Brainstorming Session: Student participation and the relevance of their contributions to the guiding questions about culture will be observed. These observations provide insight into students' prior knowledge and readiness to explore deeper cultural themes.
- Individualized Reflective Learning: Students will then complete a written reflection on their own cultural traditions and values on a reflection journal. This task will be assessed for depth of thought, personal connection, and clarity. These reflections allow students to express individual experiences while also building classroom appreciation for diversity.
- Cooperative Learning: In pairs, students will analyze images of Indigenous artifacts using a See-Think-Wonder chart. The charts will be reviewed to assess the students' ability to observe details, make interpretations, and generate meaningful questions. These skills are essential to fostering curiosity and cultural analysis.
- Group Presentation: Each group will present their chart to the class, which provides an opportunity to assess oral communication, teamwork, and engagement with cultural inquiry. Presentations will be evaluated based on clarity, content, and critical thinking.
- Exit Ticket (Optional): Ask students to write brief responses to the following prompts:
  - What is one new thing you learned today about culture or cultural artifacts?
  - Why do you think it's important to learn about and preserve cultural traditions and artifacts?

    (The activity uses reflective metacognition to gather evidence of student understanding. This practice reinforces the Diné Standard by cultivating respect, balance, and responsibility toward cultural preservation.)

Summative Assessment:

- Cultural Reflection Homework:
  - How does learning about your own culture help you understand and respect the cultures of others?
  - If you could design or preserve one cultural object from your family or community using 3D design or printing, what would it be and why?

  (The activity builds Community Relevance and Student Voice by linking traditional cultural meaning to technology, allowing students to express identity through respectful innovation. This integrates Multiple Ways of Knowing by combining creative, cultural, and technological reasoning. It fully reinforces Diné values, embodying hózhó between tradition and innovation, demonstrating K'é (responsibility), and reflecting understanding of cultural continuity.)

Lesson 3: Intro to 3D Modeling with Tinkercad

Learning Objectives:

By the end of this lesson, students will be able to:

1. Identify and apply key 3D design tools and functions in Tinkercad to create digital models.
2. Demonstrate technical skills in resizing, aligning, grouping, and exporting 3D objects for printing.
3. Reflect on how 3D design can be used to express cultural values and community identity.
4. Connect the principles of precision, balance, and respect in design to the Diné concept of *hózhó*.
5. Exhibit creativity and problem-solving by developing original 3D models using appropriate tools and digital processes.

Alignment to Standards:

- Arizona Educational Technology Standards (ETS), Grades 6-8 (Arizona Department of Education, 2022)
  - Standard 1: Empowered Learner (1.a) - Students articulate learning goals and use technology to achieve them.
  - Standard 4: Innovative Designer (4.a, 4.b, 4.d) - Students engage in a design process, select tools to manage it, and persevere through challenges.
  - Standard 6: Creative Communicator (6.b) - Students produce original designs and responsibly repurpose these as creative works.
- Arizona Computer Science Standards (Grades 6-8)
  - CS.DD.02.01 - Use digital tools to design and create digital artifacts (Arizona Department of Education, 2018).
- Culturally Responsive Assessment of Indigenous Schooling (CRAIS) Tool (Castagno et al., 2023).
  - Student Voice and Agency: Students express ownership of learning by articulating challenges, ideas, and design meanings.
  - Community Relevance: Learning connects modern technology (3D design) with community and cultural preservation.
  - Multiple Ways of Knowing: Lessons integrate hands-on, visual, oral, written, and reflective learning processes.
  - Authentic Assessment: Understanding is demonstrated through creative production and reflection rather than standardized testing.
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S1: Encourages thoughtful and ethical use of technology as a creative tool.
    - DCB.S3: Fosters accountability in using resources responsibly.
  - Diné Culture Standards:
    - DCC.S1: Demonstrate respect for self, others, and the environment by practicing *hózhó*.
    - DCC.S2: Identify and express Diné teachings, values, and practices through creative and technological processes.
  - Diné History Standards:
    - DHS.S1: Examine the significance of cultural artifacts and creative works as a means of preserving Diné identity.
    - DHS.S2: Connect past and present cultural practices through design and analysis.

Instructional Strategies:

1. Direct Instruction and Demonstration: Building Foundations
   - Build students' foundational skills in 3D design by demonstrating the step-by-step core tools and functions of Tinkercad using a projector or screen-sharing platform. This will ensure that all students become familiar with the Tinkercad interface and can confidently navigate and manipulate basic design elements. Students are introduced to the Tinkercad interface through a teacher-led demonstration that highlights core functions such as navigating, creating, resizing, aligning, grouping, and exporting 3D models.

- A printed or digital Tinkercad Quick Guide will be provided. This guide will include labeled diagrams and brief descriptions of each function covered in the demonstration, serving as both an in-class support and a future resource for independent work.
- To reinforce learning, the session concludes with a CRAIS "Check for Understanding" moment**,** where students express what they have learned and any challenges faced verbally or digitally, supporting Student Voice and Agency (Castagno et al., 2023).
    - Encourage reflection by asking:
        - "How does learning precision and design relate to the Diné value of *hózhó*, in the things we create?"

(The activity integrates Authentic Assessment and Student Voice by having students verbalize their understanding, reflect on challenges, and discuss how technology aligns with cultural principles. This blends Multiple Ways of Knowing through hands-on learning, reinforcing Diné Hózhó for mindful digital creation and cultivating Responsibility for the ethical use of technology.)

2. Guided Hands-On Practice: Practicing Skills

   Students will apply their newly acquired skills in a structured, creative task. This exercise reinforces fundamental Tinkercad features and promotes student participation and problem-solving skills, acting as an essential link between teacher-led modeling and autonomous design work.
   - Each student will create a custom keychain using 3-5 basic shapes within the Tinkercad workspace. The goal is to produce a simple, personalized object that demonstrates mastery of the foundational design tools introduced earlier.
   - Provide a digital or printed task card outlining the step-by-step process. The class may complete the first one or two steps together *(e.g., creating a new design and placing a base shape)*, after which students will continue at their own pace while referring to the guide.
   - Circulate actively around the classroom, observing students' work and providing real-time support. This ensures that all students stay on track and correctly apply the targeted tools. Also, offering feedback through open-ended prompts such as:
       - "What story or meaning might your design represent?"
       - "How does your design show precision and balance?"

   (The activity builds Community Relevance and Student Voice by linking design to personal/cultural symbolism. The teacher uses dialogue for formative assessment, reinforcing relational learning. This aligns with Diné Standards, encouraging students to interpret cultural teachings through art and recognize that designed objects preserve identity.)

3. Independent Creative Task: Designing Independently (This could be done on another day or optional):

   To deepen their understanding and encourage creative application of 3D design skills, students will complete an independent design challenge using Tinkercad. This task gives students the opportunity to apply what they have learned in a self-directed, open-ended project that fosters both technical skill and imaginative thinking. Students will be challenged to design an original 3D object of their choice using Tinkercad and they will be encouraged to think creatively.
   - Provide Sample project ideas such as a mini planter or flower pot, a custom game token or board piece, a small decorative sculpture, or a basic tool or key accessory *(e.g., phone stand, keychain)*
   - Student are required to use at least four Tinkercad Functions.
   - Process Steps:

    - Planning: Students will sketch or describe their design idea before beginning, helping them clarify their concept and identify which tools they will need.
    - Designing*:* Students will work independently in the Tinkercad environment, applying their skills to create their chosen object.
    - Exporting*:* Save as STL file to their local computer.
    - Slicing*:* To prepare the 3D model for printing by converting the STL file into a G-code file.
- Throughout the process, students receive teacher feedback and peer input, mirroring Student Voice and Agency (CRAIS) to ensure students are meeting technical requirements. Monitor and support students as they work, answering questions and offering design suggestions when needed. Encourage individual creativity while reinforcing the correct and effective use of Tinkercad features.

(The activity integrates Student Voice and Agency, Authentic Assessment, and Multiple Ways of Knowing by empowering self-directed, hands-on creation and reflection. This reinforces Diné Standards, promoting Hózhó by honoring the relationship between people, technology, and the environment, and fostering responsibility for both resources and cultural/environmental harmony.)

Learning Resources:

- Classroom projector or screen-sharing platform
- Computers with internet access and Tinkercad accounts
- Tinkercad Quick Guide (digital or printed) with visual tool references
- Printed task cards for the guided keychain activity
- Access to slicing software (Ultimaker Cura)
- USB drives or SD cards for transferring files to 3D printers
- 3D printer (Ultimaker or similar) and filament
- Sketch paper or notebooks for planning original designs
- Sample student designs for inspiration
- Reflection Journal

Assessment:

Formative Assessment:

Assessment throughout this lesson will be both formative and performance-based to monitor students' progress and support individualized learning.

- During the Direct Instruction and Demonstration phase, assessment will focus on authentic engagement and understanding of the Tinkercad interface. Students' participation will be observed, noting how they respond to questions and follow along with the live modeling demonstration. These real-time observations will reveal whether students can correctly identify and use the basic functions of Tinkercad, such as resizing, aligning, and grouping shapes.
- In the Guided Hands-On Practice, each student's progress will be evaluated by reviewing their developing keychain projects. As students apply resizing, aligning, grouping, and exporting techniques, the teacher will circulate the classroom, providing feedback and support as needed. Assessment during this stage focuses on students' ability to accurately use digital design tools while integrating elements of meaning or cultural symbolism into their work.
- During the Independent Creative Task, assessment will emphasize Student Agency by observing how students take initiative and demonstrate independence in their 3D design

projects. Student progress will be monitored, offering guidance and recording evidence of problem-solving, creativity, and perseverance. Students' designs will be reviewed for originality, tool accuracy, and evidence of thoughtful planning.

Summative Assessment:

- The Reflection Journal Homework is a written assessment that allows students to explain what they learned, reflect on their problem-solving process, and connect 3D design principles to cultural meaning. Through guided prompts, students describe how using Tinkercad relates to the Diné concept of *hózhó* and how technology can serve their community. Reflections will be evaluated for depth of thought, personal insight, and the ability to relate 3D design learning to real-life and cultural contexts.

  Reflection Prompts:

  1. What was the most challenging part of learning to use Tinkercad today, and how did you overcome it?
  2. If you could improve your keychain or original 3D object, what would you change and why?
  3. How do you think 3D design and printing could be useful in real life or in your community?
  4. How does your design or learning process reflect the Diné principle of *hózhó* in the way we create, share, or care for our community?

  (The activity builds Student Voice and Agency through personal reflection and strengthens Community Relevance by connecting learning to community well-being. It reinforces Multiple Ways of Knowing by valuing emotional and written insight. This entire process supports Diné Standards, promoting balance and harmony in creation, the interpretation of cultural lessons, recognition of cultural continuity, and responsible self-expression.)
- The exported STL and G-code files, along with the final printed model, will serve as summative performance assessments.
  - Evaluates four categories:
    - Technical Accuracy: Proficient use of 3D design tools.
    - Creativity and Originality: Innovation in form and concept.
    - Cultural Reflection*:* Representation of *hózhó* and personal/community meaning.
    - Completion and File Management: Proper STL and G-code export and preparation for printing.

  (The activity uses Authentic Assessment by evaluating learning through the tangible design outcome instead of a test. This reinforces Diné Standards, demanding balance and respect for the significance of artifacts by ensuring the design honors both cultural identity and environmental harmony.)

Lesson 4: Designing with Cultural Meaning

Learning Objectives:

By the end of this lesson, students will be able to:

1. Identify and select a culturally meaningful object or symbol that reflects personal, community, or Indigenous heritage.
2. Research and describe the origin, meaning, and use of the chosen cultural symbol using credible sources, including family and community knowledge.
3. Demonstrate respect for cultural protocols and *hózhó* when discussing and documenting cultural artifacts.

4. Explain how cultural symbols convey values, stories, and identity within Diné and global communities.
5. Connect their cultural research to design thinking by organizing ideas for a future 3D model that honors their cultural heritage.
6. Reflect on how learning about cultural symbols strengthens identity, community responsibility, and appreciation for multiple ways of knowing.

Alignment to Standards:

- Arizona K-12 Academic Standards - Visual Arts (Grades 6-8) (Arizona Department of Education, 2015)
  - VA.CR.1.6a**:** Combine ideas to generate an innovative idea for art-making.
  - VA.CR.2.6a**:** Demonstrate openness in trying new ideas, materials, methods, and approaches in making works of art or design.
  - VA.RE.7.6a**:** Identify and interpret works of art or design that reveal how people live around the world and what they value.
- Arizona Social Studies Standards - Inquiry and Literacy Skills (Arizona Department of Education, 2018)
  - SS.IS.1.6-8: Develop questions and plan inquiries.
  - SS.IS.2.6-8: Evaluate the credibility of a source by determining its relevance and intended use.
- Culturally Responsive Assessment of Indigenous Schooling (CRAIS) Framework (Castagno et al., 2023)
  - Student Voice and Agency: Students express cultural identity and meaning through self-directed inquiry.
  - Community Relevance: Learning connects classroom inquiry to family, community, and Indigenous knowledge systems.
  - Multiple Ways of Knowing: Indigenous oral traditions, storytelling, and lived experiences are valued alongside academic research.
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S1: Demonstrate respect, responsibility, and positive relationships through cultural values.
  - Diné Culture Standards:
    - DCC.S1: Demonstrate *hózhó* when engaging in cultural learning.
    - DCC.S2: Identify and describe Diné cultural teachings, values, and practices through traditional and contemporary expressions.
  - Diné History Standards:
    - DHS.S1: Examine the significance of Diné cultural artifacts, oral traditions, and historical experiences to strengthen cultural identity.

Instructional Strategies:

1. Initial Brainstorming Session: Honoring Identity and Community
This opening activity establishes a culturally responsive foundation by centering on student identity, community voice, and cultural relevance, key principles of the CRAIS Tool (Castagno et al., 2023). Students begin by reflecting on personal and communal symbols to activate prior knowledge and connect learning to lived experience.

- Class Activity: Begin with the guiding question:
  - "What symbols, objects, or patterns represent something important to your identity or community?"
- Allow 2-3 minutes for quiet reflection or journaling. Then facilitate a sharing circle where each student may volunteer to share their symbol or story.
- Record contributions on a class chart or digital board to visually represent the community's collective knowledge.
- Highlight the diversity, meaning, and significance of shared items such as clan symbols, basket patterns, jewelry, pottery, beadwork, or traditional tools.
- Use this time to emphasize *hózhó* in valuing every voice and ensuring equitable participation.

(The activity builds Student Voice and Agency by encouraging personal expression of cultural identity through symbols. The resulting knowledge chart establishes Community Relevance by drawing on lived experiences. This process reinforces Diné Standards, demanding hózhó and the identification of cultural teachings, while building K'é (kinship), respect, and mutual understanding through collective sharing.)

2. Mini-Research Workshop: Investigating Cultural Significance
   Students extend their learning by researching the origins, meanings, and uses of their chosen cultural symbols through both academic and community-based inquiry, fostering intergenerational learning and critical thinking.
   - Guided Research: Model how to investigate cultural artifacts through diverse and credible sources:
     - Books and classroom texts
     - Educational websites and museum archives
     - Interviews with family members, elders, or cultural leaders
   - Provide explicit instruction on ethical and respectful information gathering, emphasizing cultural protocols and acknowledgment of sources.
   - Students take notes using bullet points or sketches focused on:
     - Origin: Where does the symbol or object come from?
     - Meaning: What values, stories, or teachings does it represent?
     - Use: Is it functional, ceremonial, or decorative?
   - Distribute a structured Design Research Worksheet or digital template that includes space for writing, drawing, and organizing findings.

   (The research integrates Multiple Ways of Knowing by validating Indigenous oral histories alongside academic inquiry, fostering Community Relevance through intergenerational learning with elders. This approach nurtures hózhó by connecting past and present through reflection. It reinforces Diné Standards by examining the significance of traditions, identifying cultural teachings, and demanding respect and responsibility in research protocols.)

Learning Resources:

- Culturally relevant texts or storytelling resources from library or online
- Visual Guide with examples of symbols from diverse cultures
- Video Clips of Native artists or cultural bearers explaining the meaning of traditional symbols and YouTube channels of different native cultures.
- Design Research Worksheet (Digital or Printed)
- Interview Guideline Sheet for family or elder engagement
- CRAIS Reflection Chart for documenting cultural connections
- Design Research Worksheet" (printed or digital)
- Pencils, sketch pads, or drawing apps

- Computer with Tinkercad app

Assessment:
Formative Assessment:
- Observation and Participation**:** Observe engagement during the brainstorming circle using a checklist to document equitable participation and cultural.
- Research Worksheet**:** Review clarity, accuracy, and completeness in describing the symbol's origin, meaning, and use. Check for proper note-taking and cultural awareness.
- Exit Ticket: Ask students to respond briefly: "What is one new thing you learned today about your culture or someone else's?"

(These assessments emphasize authentic, performance-based learning where students demonstrate understanding through discussion, observation, and self-reflection rather than traditional tests. Each form of assessment nurtures hózhó by balancing personal insight with communal respect.)

Summative Assessment:
- Reflection Journal Homework:
  - Students write a reflection addressing:
    1. What cultural symbol did you choose, and why is it meaningful?
    2. What did you learn from your research or interviews?
    3. How can 3D design be used to preserve or share cultural stories?
    4. How does this learning reflect *hózhó* in your community?
  - Students will be evaluated on their understanding of the cultural meaning and significance of their chosen symbol, the clarity and organization of their research, and the depth of personal reflection connecting cultural knowledge to design. Strong performance demonstrates respect for *hózhó*, authentic expression of identity, and the integration of CRAIS principles (Student Voice**,** Community Relevance**,** and Multiple Ways of Knowing) through culturally informed and meaningful design work.
- Interview a family member or elder about a cultural item or tradition not discussed in class.
- Refine your rough sketch and begin planning how it could be translated into a 3D object using Tinkercad tools introduced in previous lessons.

(The summative assessment uses personal reflection and culturally grounded expression to showcase Student Voice and Agency and Authentic Assessment. Students' writing demonstrates a holistic balance (hózhó) of growth, while reinforcing Diné Standards for balance in design and community harmony, the integration of cultural values, and the exhibition of respect and responsibility in cultural interpretation.)

Lesson 5: Design Refinement
Learning Objectives:
By the end of this lesson, students will be able to:
1. Apply constructive peer and teacher feedback to improve their 3D design projects in Tinkercad.
2. Demonstrate understanding of the design revision process by modifying original models based on feedback.
3. Communicate clearly and respectfully when giving and receiving feedback.
4. Reflect on how *hózhó* and *K'é* guide collaboration and improvement in design.
5. Express their learning process through written reflection that connects design refinement to personal growth and community relevance.

Alignment to Standards:

- Arizona Educational Technology Standards (ETS)
  - Standard 1: Empowered Learner (Indicator 1.c) - Students integrate feedback from peers and digital tools to improve their learning process.
  - Standard 4: Innovative Designer (Indicators 4.a, 4.b) - Students participate in a design process by using technology to plan, test, and iterate solutions.
  - Standard 6: Creative Communicator (Indicator 6.b) - Students create and share original digital artifacts and responsibly repurpose feedback to improve them (Arizona Department of Education, 2009).
- Arizona Visual Arts Standards (2015)
  - Anchor Standard #3: Refine and complete an artistic work.
  - Anchor Standard #1: Generate and conceptualize artistic ideas and work (Arizona Department of Education, 2015).
- CRAIS Framework (Castagno et al., 2023)
  - Student Voice and Agency: Students lead their learning by sharing perspectives and making choices in how to apply feedback.
  - Community Relevance: Collaboration emphasizes mutual respect and responsibility, aligning with Indigenous values of relational learning.
  - Multiple Ways of Knowing: Students use verbal, written, and visual forms of feedback and reflection, acknowledging diverse communication styles.
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S1: Show respect, humility, and responsibility when offering and receiving feedback.
    - DCB.S2: Demonstrate positive relationships through *K'é*.
  - Diné Culture Standards:
    - DCC.S1: Demonstrate *hózhó* in collaborative learning and creative processes.
  - Diné History Standards:
    - DHS.S1: Reflect on how continual improvement and collaboration preserve and strengthen cultural identity and creativity.

Instructional Strategies:

6. Lesson Introduction**:** Honoring Growth and Balance through Feedback

- Begin the class by projecting or writing the day's objective on the board: "Today we will enhance our 3D designs by applying constructive feedback from peers and the teacher."
- Facilitate a brief discussion:
  - Ask students, "Why is feedback important in the design process?"
  - Encourage them to connect their experiences with revising artwork, writing drafts, or coding and engineering improvements.
  - Emphasize that feedback and refinement represent *hózhó*, reflecting harmony and continual growth (Navajo Nation Department of Diné Education, n.d.) and is a critical step in professional 3D modeling and engineering workflows.

(The activity sets a culturally responsive foundation for Student Voice and Agency by having students connect their personal experiences to feedback, which honors Community Relevance by making reflection a communal value. Linking critique to Diné hózhó ensures students view it as a balanced, relational exchange that fosters respect, humility, and continual improvement.)

7. Direct Instruction: Feedback Framework Overview

- Introduce the TAG feedback method:
  - **T**ell something you like
  - **A**sk a question
  - **G**ive a suggestion
- Model how to give effective, respectful, and specific feedback using a sample 3D design from Tinkercad. Show a simple object and ask the class to participate in providing TAG feedback. Note their responses on the board.

(The activity integrates Multiple Ways of Knowing (verbal, written, visual) and Authentic Assessment through practice with constructive feedback. This relational dialogue reinforces Diné Standards, teaching students to express cultural teachings through contemporary means and demonstrate K'é (cooperation and respect) by working collaboratively within the learning community.)

8. Peer Feedback Activity: Practicing *K'é* through Collaboration

- Pair or group students (2-3 per group).
- Each student opens their saved Tinkercad design from a previous session. Using a Peer Feedback Sheet (printed), students will:
  - Review a classmate's design.
  - Offer feedback using the TAG method.
  - Write their suggestions clearly and respectfully.
  - Discuss the feedback they receive and ask clarifying questions.
- If time permits, rotate groups so each student receives multiple perspectives.

(This cooperative task builds Community Relevance and Student Voice and Agency through the exchange of meaningful critique, modeling collective responsibility and culturally responsive assessment. The process reinforces Diné hózhó and teaches K'é (kinship), demonstrating that shared growth is a reciprocal process that sustains harmony and cooperation.)

9. Teacher-Guided Feedback

- As students engage in peer review, circulate the room to observe, offer verbal feedback, and provide visual guidance through quick sketches or modeling on Tinkercad. Identify recurring strengths and challenges, and offer real-time coaching that encourages both technical growth and reflection on *hózhó (maintaining harmony between design precision and creativity).*

(The strategy utilizes relational dialogue as Authentic Assessment, building Community Relevance through ongoing conversation. The teacher acts as an Indigenous mentor, reinforcing the Diné principle of Nitsáhákees doo Nahata (thinking and planning). This process maintains hózhó through encouragement, models responsibility and humility, and honors learning as a relational practice that sustains knowledge continuity.)

10. Design Revision Time

- Students return to their designs and select at least two pieces of feedback to apply.
- They may duplicate their design to create a "before and after" comparison or label design versions clearly.
- On the Peer Feedback Sheet, students write short reflections:
  - "What feedback did I apply?"
  - "What changes did I make and why?"

(This reflective step builds Student Voice and Agency through documented progress, integrating Multiple Ways of Knowing via technical, emotional, and cultural reflection. It reinforces Diné Standards by applying Hózhó between creativity and precision and cultivating responsibility and persistence. This process ultimately fosters Siihasin (self-assurance) through improvement guided by cultural balance.)

Learning Resources:

- Tinkercad
- Projector or screen sharing setup for demonstration
- Peer Feedback Sheet
- Sample 3D Tinkercad design for modeling
- Laptops or computers with internet access
- Exit Ticket Prompt
- Reflection journal

Assessment:
Formative Assessment:

- Observation & Circulation: Monitor peer interactions and ensure feedback remains constructive and culturally respectful, documenting examples of *K'é* and collaboration.
- Peer Feedback Sheet: Evaluate how effectively students use the TAG framework, focusing on respectful tone and actionable suggestions.
- Design Revision Reflection: Assess each student's written explanation of which feedback they applied and how it improved their design, reinforcing *hózhó* and self-awareness.
- Exit Ticket: "What is one-way peer feedback helped you improve your design today?" *(Responses provide insight into the student's growth mindset and appreciation for shared learning.)*

Summative Assessment:
Students respond to the following questions in their journals:

- Reflection Journal Homework:
  1. What did I learn about my own design from my classmates' feedback?
  2. How did I feel giving and receiving constructive feedback?
  3. If I had more time, what additional changes would I make to improve my design further?

  (This final reflection acts as an Authentic Assessment of Student Voice and Agency by having students reflect on the emotional and relational aspects of feedback, building accountability and humility. It reinforces Diné hózhó and requires students to apply traditional values of respect and improvement to their modern 3D creative work.)

Lesson 6: 3D Printing and Presentation Preparation

Learning Objectives:

By the end of this lesson, students will be able to:

1. Finalize their 3D designs by applying previous feedback while maintaining technical precision and cultural authenticity.
2. Demonstrate cooperation and responsibility (*K'é*) during 3D printing setup and operation.
3. Create a digital presentation that communicates both the technical process and the cultural meaning of their 3D design.
4. Reflect on how *hózhó* and community collaboration guide their creative process.
5. Express cultural identity and understanding through multiple modes of communication (oral, visual, and digital).

Alignment to Standards:

- Arizona Educational Technology Standards (ETS 2022)

- Standard 1: Empowered Learner (Indicator 1.c) - Students integrate feedback from people and digital tools to improve their learning process.
- Standard 6: Creative Communicator (Indicator 6.b) - Students create original digital artifacts and prepare presentations conveying cultural meaning and design choices (Arizona Department of Education, 2022).

- Arizona Visual Arts Standards (2015)
  - Anchor Standard 5: Develop and refine artistic techniques and work for presentation. Anchor Standard 6: Convey meaning through the presentation of artistic work (Arizona Department of Education, 2015).
- CRAIS Framework (Castagno et al., 2023)
  - Student Voice and Agency: Learners lead and express their learning through design and storytelling.
  - Community Relevance: Learning connects technology, art, and culture to Indigenous knowledge systems.
  - Multiple Ways of Knowing: Learning honors oral, visual, and digital communication as valid ways of understanding and expressing knowledge.
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S1: Show respect, responsibility, and humility when representing cultural symbols and community values.
    - DCB.S2: Demonstrate *K'é* when collaborating and supporting peers.
  - Diné Culture Standards:
    - DCC.S1: Demonstrate *hózhó* through creative and reflective learning.
    - DCC.S2: Identify and describe Diné cultural teachings and values through artistic and contemporary expression.
  - Diné History Standards:
    - DHS.S1: Reflect on the significance of cultural artifacts, connecting tradition to modern digital design.

Instructional Strategies:

1. Introduction & Agenda Overview: Honoring Purpose and Balance
   - Begin the session by welcoming students and outlining the day's goals: finalizing designs, starting 3D printing, and preparing presentation slides. Reiterate the importance of communicating not only the technical process but also the cultural meaning of their designs during presentations.

   (The activity champions Student Voice and Agency as learners present their designs as personal and cultural stories. This reinforces DINÉ Standards, specifically supporting hózhó and K'é by melding creativity with genuine cultural understanding.)
2. Refining the Work: Finalizing 3D Designs with Meaning
   - Students open their Tinkercad projects and make any necessary final adjustments based on peer or teacher feedback from previous lessons. Teachers provide individual guidance, ensuring each design maintains both technical accuracy and cultural authenticity before exporting for printing.

(The activity integrates Multiple Ways of Knowing as students blend community feedback, personal reflection, and technical skills. This process reinforces Diné hózhó by encouraging mindful improvement and reflection on how their designs actively preserve cultural meaning.)

3. 3D Printing Setup: Preparing for 3D Printing
   - Students export STL files and use Ultimaker Cura (or similar software) to slice their designs. They take turns initiating prints or placing files into the print queue, demonstrating responsibility in handling equipment and respect for shared resources.

   (The activity builds Community Relevance through shared, collaborative work. This is grounded in DINÉ Standards, reinforcing K'é (cooperation) and hózhó by promoting patience, respect, and teamwork.)
4. Presentation Planning Workshop**:** Developing Cultural and Technical Narratives
   - Distribute a presentation planning guide that includes:
     - Project Title
     - Description of the cultural symbol or object and its significance
     - Overview of design process (planning, feedback, revision)
     - Final reflection: what they learned
   - Students begin developing presentation slides that tell their project's technical journey and cultural story. The teacher circulates to support clarity, organization, and confidence building, reinforcing the connection between cultural identity and creative practice.

   (The activity builds Student Voice and Agency by giving students ownership of their stories, embracing Multiple Ways of Knowing through oral, visual, and digital expression. This reinforces DINÉ Standards by promoting cultural expression, responsibility, and respect through proud storytelling.)
5. Wrap-Up & Preview
   - Conclude the session by reminding students to finish their slides and prepare for next class presentations. Confirm the 3D printing schedule and explain how the class will showcase projects once printing is complete.

   (The activity builds Community Relevance through collective reflection and preparation for sharing. This reinforces the DINÉ Standards of hózhó and gratitude as students responsibly finalize their creative contributions.)

Learning Resources:

- Tinkercad (www.tinkercad.com)
- Ultimaker Cura slicing software
- Laptops or desktops with internet access
- 3D printer
- USB drive or SD card for transferring G-code files
- Projector/Screen and presentation equipment
- Student handout: Presentation Planning Guide
- Peer Feedback Sheet from Lesson 5 for reference

Assessment:

Formative Assessment:

- Teacher Observation: Observe students' engagement, collaboration, and respect during final design and printing setup. Note evidence of *K'é* and *hózhó* in how they handle materials and support one another.
- Checklist: Confirm that students successfully export, slice, and prepare files for 3D printing. Evaluate for accuracy and responsibility in the process.
- Presentation Plan Review: Review students' presentation outlines for completeness, organization, and clarity in describing both cultural meaning and design development.

- Exit Ticket: "What is one thing you are proud of in your project, and what is one thing you still need to work on before your presentation?" (Responses provide insight into self-awareness and personal growth, key indicators of Student Voice and Reflection under the CRAIS Tool.)

(This activity reinforces Diné harmony (ho'zho') by balancing self-reflection with creative work, while cultivating responsibility and humility as students recognize both their growth and areas needing improvement.)

Lesson 7: Presentation of 3D cultural designs and Reflection

Learning Objectives:

By the end of this lesson, students will be able to:

1. Communicate the cultural meaning and design process behind their 3D-printed projects with clarity and confidence.
2. Demonstrate respectful listening and feedback skills that reflect *hózhó* and *K'é*.
3. Apply culturally responsive communication by connecting their artwork to personal and community identity.
4. Reflect on the role of cultural artifacts and digital design in expressing and preserving Indigenous traditions.
5. Engage in peer learning and self-reflection, demonstrating responsibility, humility, and cultural pride.

Alignment to Standards:

- Arizona Visual Arts Standards (According to 2015 guidance)
  - Anchor Standard #5: Develop and refine artistic techniques and work for presentation.
  - Anchor Standard #6: Convey meaning through the presentation of artistic work.
  - Anchor Standard #8/9: Interpret intent and apply criteria to evaluate artistic work (Arizona Department Education, 2015).
- Arizona Educational Technology Standards (ETS) - Grades 6-8
  - Standard 6: Creative Communicator (Indicator 6.b) - Students share their original 3D artifacts and explain design story and cultural significance through digital/presentational means (Arizona Department Education, 2022).
- Arizona ELA / Presentation Skills (Grade 8-level, aligned)
  - SL.8.1: Engage effectively in collaborative discussions (Arizona Department Education, 2016).
- CRAIS (Culturally Responsive Assessment of Indigenous Schooling) Framework (Castagno et al., 2023):
  - Student Voice and Agency: Empowering students to share their cultural knowledge through art and technology.
  - Community Relevance: Centering local and Indigenous perspectives in creative learning.
  - Multiple Ways of Knowing: Valuing oral storytelling, visual art, and digital media as valid ways of knowing and demonstrating understanding.
- Diné Content Standards (Navajo Nation Department of Diné Education, n.d.)
  - Diné Character Building Standards:
    - DCB.S1: Demonstrate respect, responsibility, and positive relationships through cultural values.
    - DCB.S3: Practice self-reflection and express pride in one's cultural identity.
  - Diné Culture Standards:

- DCC.S1: Demonstrate *hózhó* by showing respect for self, others, and the environment.
- DCC.S2: Identify, describe, and interpret Diné cultural teachings and values through traditional and contemporary forms of expression.

- Diné History Standards:
  - DHS.S1: Examine the significance of Diné cultural artifacts, oral traditions, and historical experiences to strengthen identity.
  - DHS.S2: Connect past and present cultural practices through analysis and presentation.

Instructional Strategies:

1. Welcome and Framing: Honoring Stories and Setting Intentions
   - Begin by welcoming the class to their presentation day.
   - Write the objective on the board: "Today we will share our 3D printed designs and explain the cultural meaning behind them."
   - Revisit community expectations for respectful listening and cultural sensitivity by asking:
     - Discuss: "Why is it important to honor others' stories and cultural symbols?"
     - Reintroduce sentence starters for peer feedback: "I noticed…" "I learned…" "It reminds me of…"

   (The activity activates Student Voice and Agency by focusing on students' lived experiences, which builds Community Relevance through collective respect for cultural storytelling. This reinforces the Diné values of hózhó and K'é during relational dialogue.)
2. Student Presentations: Presenting Cultural and Creative Designs
   - Students take turns presenting their 3D printed designs**,** explaining both the technical process and the cultural meaning behind their creations. Each presentation should include:
     - Displaying both the physical 3D object and digital Tinkercad model**.**
     - Explaining the cultural or symbolic significance and the research process.
     - Describing how feedback was integrated during the design refinement phase.
     - Responding to respectful follow-up questions from classmates.
   - Encourage classmates to actively listen and ask respectful follow-up questions.

   (The activity builds Student Voice and Agency through digital storytelling, embracing Multiple Ways of Knowing by combining oral, visual, and technological expression. This reinforces DINÉ Connections as students interpret cultural teachings via modern media, connect tradition and innovation, and demonstrate humility and respect in their presentations.)
3. Group Reflection: Reflecting on Learning and Harmony
   - After all presentations, bring students together in a reflection circle to honor the learning process as a community.
   - Ask reflective questions such as:
     - "What did you learn from a classmate's presentation that stood out to you?"
     - "How do our designs show the diversity and richness of our identities?"
     - "In what ways did our work together demonstrate *hózhó* and *K'é*?"

   (The activity builds Community Relevance by defining learning as a shared experience. Reflection circles serve as culturally responsive assessments, valuing relationships and listening as key to success. This reinforces DINÉ values, promoting hózhó, K'é, and cultural continuity.)

Learning Resources:

- 3D printed student models
- Projector/screen for digital display

- Peer Feedback Sheets
- Presentation
- Rubric for Presentation Evaluation
- Printed Student Handouts: presentation outline, reflection prompts, and feedback guide

Assessment:
Formative Assessment:
- Peer Feedback Sheet:
  - Students complete at least 1-2 forms using the TAG method. Feedback is evaluated for specificity, positivity, and cultural sensitivity (evidence of *K'é* and collaborative learning).
- Teacher Observation:
  - Observe student presentations and note engagement, attentiveness, and demonstration of *hózhó* and *K'é* during feedback exchanges. Observational notes serve as qualitative evidence of Community Relevance and Student Voice in the CRAIS framework.

Summative Assessment:
1. Reflection Journal Homework:
   - Students will answer the following:
     1. What inspired your design, and what did it mean to share it with the class?
     2. What feedback or comment from a peer meant the most to you?
     3. How did this project help you learn more about yourself or others?
     4. What is one meaningful thing you learned about identity or culture from the presentations?

   (The activity captures Student Voice and Reflection, enabling learners to express their inner understanding of culture and identity. This process reinforces Diné hózhó through self-reflection and cultivates K'é (responsibility and respect) by acknowledging the shared learning environment.)
2. Presentation Rubric**:**
   Presentations are evaluated using a rubric based on the following criteria:
   - Cultural Understanding: Clarity in explaining cultural or symbolic meaning.
   - Design Process: Demonstrates mastery of design tools and revision steps.
   - Communication: Speaks clearly, confidently, and respectfully.
   - Community Relevance: Presentation connects cultural heritage to innovation and collaboration.
   - Reflection and Responsibility: Demonstrates gratitude, respect, and awareness of cultural representation.

   (This rubric ensures culturally responsive assessment by integrating Student Voice, Community Relevance, and Multiple Ways of Knowing. The student presentations then serve as living evidence of Diné values, embodying hózhó, K'é, and cultural continuity through innovative artistry.)

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