Educating About and With Technology: Empowering Indigenous Students and Communities

The Flip Side: Using 3D Printing and 3D Pens to Explore Identity and Culture

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Teacher Leadership Shiłgozhóó Institute (TLSI)

2025

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Topic and Context

"Leugim"
A student once wrote his name as Leugim. When someone called him, he didn't respond; his head was down, and he didn't even flinch. In Leugim's world, letters fly, and words move in the opposite direction—from right to left. In his mind, letters and words are written that way. From the world's perspective, Leugim appears slow, unable to catch up, and doesn't seem to belong to his age group's learning level. He doesn't respond when called not because he doesn't want to, but because that is not his name. He spells backward, which is why this curriculum unit has been created. It aims to help students like Leugim express their identities in the way they wish to. This curriculum unit will help Leugim write his name as "Miguel."

This curriculum unit is designed for seven 3rd-grade students with learning disabilities at Rice Intermediate School in the San Carlos Unified School District, Arizona. Rice Elementary School, situated in a rural town setting in San Carlos, serves a total student population of 642 students from pre-kindergarten through 5th grade. The demographic breakdown consists of 47% female students and 53% male students, with 87% of the students coming from economically disadvantaged backgrounds.

These third-grade students have Individualized Education Programs (IEPs) that outline their academic, behavioral, and social goals for the 2025-2026 school year. They have been part of the resource program since Primary school. Despite receiving special education services, they continue to fall behind their peers. The IEPs of these third graders already include specially designed instruction tailored to their unique needs. However, given the growing importance of technology and its positive impact on education, these students will also have access to innovative technologies.

This curriculum unit utilizes 3D printers and pens to enhance the learning experience for 3rd-graders with learning disabilities who are performing below grade level in reading and writing. This demands a more interactive and involved approach to learning, as the traditional teaching methods often don’t work for everyone. A multisensory approach helps these learners build the skills they need to thrive in a regular classroom setting. By tapping into different senses, we can create a richer learning experience that better supports their success.

The technology is utilized during small group instruction and one-on-one sessions in the resource room during morning pull-out periods, as well as during RTI sessions in the afternoon. The length of these pull-out sessions varies depending on the type of IEP services provided. During the RTI sessions, the primary focus of integrating technology is on writing. This approach allows students to use their output to create culturally relevant projects and teaches them how to narrate the story behind their projects through writing.

The implementation of this technology will begin as soon as the RTI session starts. The first two weeks of the class will allow the Sped teachers to assess the students initially, identifying specific areas in their goals where these technologies can be applied, as well as to understand how they learn more effectively and build rapport with them.

By the end of the first quarter, students are expected to present their work—items that are culturally relevant to their lives—through an exhibit and written narratives.

Technologies like 3D printers and pens play an essential role in supporting children with special needs, as they offer tangible ways to understand ideas and concepts. By integrating such technologies, teachers can create a more inclusive and culturally sustaining education that values and celebrates student's diverse backgrounds and experiences.

Rationale

Leugim—or shall I say Miguel—handed me a packet of worksheets given by his teacher, his head down and silent, trapped in his own world, looking sad and weary. He sat down on my wobbly blue chair, but even the chair's movement didn't affect him. No movement; he just stared at his shoes, which were mismatched—his left shoe on the right foot and his right shoe on the left foot. It seemed he couldn't hear me; he had shut down, and I couldn't reach him in his world.

Then I heard the loud roar of his stomach. So, I asked, "Have you ever tried eating a strawberry with whipped cream?" He shook his head, indicating no. I handed him two big strawberries and showed him how to add whipped cream. When I pushed the nozzle, it splattered all over the table, and he laughed, telling me to be careful. Once we both had whipped cream on top of our strawberries, we counted—1, 2, 3—and ate them. He enjoyed it. From then on, every morning, Miguel and I would eat strawberries with whipped cream while he worked happily.

I asked him what he wanted to be when he grew up. "A doctor," he replied. I joked, "So, you'll give kids an apple to stop them from crying?" He responded, "No, I'll give them strawberries with whipped cream." In our RTI class, we were writing sentences, and Miguel chose to write about strawberries with whipped cream. As Valentine's Day approached, the students were excited to design their cards. Instead of the traditional hearts, Miguel creatively opted to draw small strawberries on his card. And his favorite food, strawberry with whipped cream.

This curriculum unit aims to equip students like Miguel with engaging tools, referred to as "strawberries with whipped cream," that help them find joy in their learning experience.

"Leugim for Miguel. dat for bat. qat for pat."
Reversals of letters or words are pretty standard for students with learning disabilities. What may appear to be slowness is often rooted in challenges with visual processing and phonological skills—making letters like "b" and "d" look-alike and sounds a bit tricky to connect. It's typical for young children to mix up letters, but noticing these reversals in upper elementary grades can signal a potential issue. Hence, this is just one of the many challenges that children with specific learning disabilities (SLD) encounter. Therefore, students with learning disabilities often struggle with conventional teaching approaches, which lead to decreased motivation, behavioral issues, low retention rates, and minimal engagement. We can facilitate a multisensory learning experience that resonates with these students by employing modern technology such as 3D printers and pens (the strawberry with whipped cream).

These tools improve engagement and spark creativity. They also help students understand complex topics more easily. As a result, students gain confidence and take part more actively in class. These tools help visualize how to form letters and numbers, which in turn improves reading and math skills. They also support students in overcoming writing challenges.

Overall, developing a curriculum unit that integrates Apache culture with modern technology for 3rd-grade students with Individualized Education Programs (IEPs) aligns closely with educational philosophy and the unique needs of students at Rice Intermediate School in the San Carlos Unified School District. Apache has a rich culture; every symbol and color in their logos, pictures, traditional clothing, songs, music, animals, and livelihoods has a story, and they continually aim to share these with the next generation. Unfortunately, at our school, the Apache language is not widely spoken, which is becoming a concern. Although students at Rice Intermediate School may be familiar with some Apache language, many are hesitant to use it. Interestingly, most students enjoy conversationally sharing their stories and culture, but during class, they often hesitate to speak up due to low self-esteem.

To encourage our students to be culturally responsive and help the community preserve its heritage, we utilize 3D printers and pens. These technologies enable students to bring their ideas to life in a tangible way, boosting their confidence when presenting their work to the class. At our school, we typically showcase student work during Parent-Teacher Conferences (PTC). Despite teachers' efforts to encourage students to participate in activities such as presenting artwork, sharing stories, and writing culturally relevant pieces, a lot of students hold back from getting involved in these projects because they lack motivation and struggle with low self-confidence.

The integration of this technology allows students, including those in the ESS program, to create something meaningful. By showcasing their projects, they are empowered to speak up; having a creative piece to present instills a sense of pride that motivates students to express themselves in class. Their work will be displayed in an exhibit accompanied by a written or verbal narrative; enables them to share their stories and traditions, not only within the classroom but also with the entire school community.

In summary, through creativity and cultural expression, this curriculum unit represents a path of development that unites teachers, students, and the Indigenous community. Our aim is to cultivate a significant educational experience. that touches students' hearts and resonates in the classroom by celebrating Apache culture with 3D printers and pens.

This program emphasizes the value of a culturally sensitive education while addressing the various needs of students with disabilities. Technology integration improves comprehension and engagement, creating a welcoming atmosphere that enables our Apache students to succeed.

Instructional Guide

This curriculum unit aims to encourage students with learning difficulties to engage in self-expression and cultural discovery, primarily through the use of 3D printing technology, enabling them to break free from conventional learning constraints and embrace their identities.

Subject Matter

Using 3D printing and 3D pen technologies, this unit covers reading, writing, and artistic expression. Utilizing multimodal techniques that foster engagement and comprehension, the program is designed to support third-grade students with learning disabilities. Focusing on how students can express their cultural backgrounds, key themes encompass identity, culture, and personal narratives.

Background Ideas and Concepts

The foundation of this curriculum is an awareness of identity and culture.
As more and more students from diverse backgrounds populate 21st century classrooms and efforts mount to identify effective methods to teach these students, the need for pedagogical approaches that are culturally responsive intensifies (Richards et al., 2007). Teachers can create an inclusive classroom by honoring all identities, including multicultural references in lessons, and valuing the different histories, languages, and traditions of their students. Understanding these differences helps build strong relationships with students, leading to better academic performance and a fairer learning environment for everyone involved.

Moreover, technology, particularly 3D printing and 3D pens, plays a significant role in promoting social-emotional learning and intellectual development. According to Simpson et al. (2021), three-dimensional printing is a form of additive manufacturing that can enhance the inclusion of students with disabilities by providing low-cost, highly individualized equipment tailored to their specific needs.

In the writing sessions, students will have the opportunity to create culturally relevant projects using the 3D printer and pens. For example, they can design and print traditional Apache camp dresses, tools used for food preparation by their ancestors, sacred traditions or places, or anything that represents their Apache culture and identity. After they create their projects, they will write narratives or descriptions of their projects, incorporating Apache culture and history. When students see their work come to life using these sleek technologies, they will improve their writing skills and cultivate an ownership mindset that can boost their confidence. Students will develop a deeper awareness of involvement and motivation as they engage in practical exercises connecting them to their cultural legacy. Through hands-on learning and tactile output, the educational process will be more enjoyable and the students will take pleasure in their work as they investigate their cultures.

Involving SWDs in the design of AT can promote individualization, student autonomy, and motivation to participate (Simpson et al., 2021). Research shows that learners understand information better in the classroom when they can see it (Raiyn, 2016). With that, effectively using assistive technology can help provide quality special education for children with special needs.

Lesson Plans and Teaching Strategies

Over an eight-week period, the course will follow a disciplined series of lessons arranged into three main phases: Exploration, Creation, and Presentation.

During their pull-out session in the morning, the focus of teaching is more on reading based on their IEP goals, in which integration of 3D pens and printing happens.

Students will discuss identity and culture in the first Exploration Phase (weeks 1–2).
Introductory Activities- They would look at several instances of cultural relics, they can also gather information from their family or tribes, watch video presentations of Apache culture.
Group brainstorming activities whereby students share facets of their own cultures will help to inspire innovation. Through basic, guided activities emphasizing fine motor skill development and technological knowledge, students will master the principles of 3D printing and 3D pen use.

In the Creation Phase (weeks 3–5) every student will develop a project reflecting their cultural heritage or identity. Using either a 3D pen or a printer, they will create a plan for execution, work on writing a narrative to go with their projects, and sketch ideas. Regular small group or one-on-one sessions will offer chances for tailored instruction and feedback as students develop their projects.

Students will get ready to present their works in an exhibit in Weeks Six through Eight. They will work on honing their presentations and story-telling techniques. At the end of the unit, students will show their projects to their families and peers, thereby sharing the tales behind their work.

Assessment Plan

With an eye toward formative tests measuring student involvement and comprehension, assessment will be continuous across the unit. Every student will get personal comments on their project implementation and narrative writing, which will help them to improve their work. The last display at the end of the unit will function as a summative assessment combining the narrative and creative elements.

Sustaining and Culturally Responsive Strategies

The curriculum is designed to honor and reflect diverse cultures, enabling students to connect their personal experiences with what they learn. Lessons are structured to provide students with choices, allowing them to integrate their backgrounds into their work, thereby supporting their individuality and self-expression. Regular and constructive feedback between teachers and students ensures that lessons are rooted in students' experiences. Through hands-on activities, students can celebrate their cultural identities, fostering pride and confidence in their learning while promoting equitable educational opportunities for all.
Culturally Responsive Teaching (CRT) serves as a guiding principle for equity and inclusivity in the educational landscape. CRT emphasizes a teaching approach that recognizes and embraces the varied cultural backgrounds, experiences, and perspectives of students in the classroom. As noted by Gay (2000), "Culturally responsive teaching means using students' customs,

characteristics, experience, and perspectives as tools for better classroom instruction... It's the kind of teaching that helps students of color see themselves and their communities as belonging in schools and other academic spaces, leading to more engagement and success." This statement underscores the significance of leveraging students' backgrounds to enhance their engagement and sense of belonging.

Culturally Sustaining Pedagogy (CSP) takes this a step further by asserting that "schools should be places where the cultural ways of being in communities of color are sustained, rather than eradicated" (Paris & Alim, 2017, p. 1). This perspective reinforces the necessity of preserving and valuing students' cultural identities within the educational framework.

Building Relationships: Teachers can foster strong relationships by showing genuine care for and valuing their students, including their lives, cultures, and academic success. This can be achieved by demonstrating interest in their personal challenges, listening to their ideas, dedicating time to support them, encouraging participation in co-curricular activities, and providing timely.

Teaching Plan

Grade Level: 3rd and 4th Grade
Duration: 30 Minutes, 4 Times per Week, for 8 Weeks
Objectives:

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

- Identify and discuss various cultural artifacts, unraveling their rich histories and significance.
- Utilize Tinkercad to design 3D models that reflect their cultural backgrounds.
- Demonstrate fundamental skills in using 3D pens to bring their designs to life.
- Collaborate effectively with peers to share and present their cultural stories and designs.
- For students with writing reversals**:** Develop proper letter formation and confidence in writing using tactile 3D pen tracing activities.

Arizona State Standards

3rd Grade Reading and Writing Standards

Reading Standards:

- **RI.3.1:** Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for answers.
- **RI.3.2:** Determine the main idea of a text; recount the key details and explain how they support the main idea.
- **RI.3.7:** Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text.

Writing Standards:

- **W.3.1:** Write opinion pieces on topics or texts, supporting a point of view with reasons.
- **W.3.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- **W.3.4:** With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.
- **W.3.5:** Develop and strengthen writing as needed by planning, revising, and editing.

4th Grade Reading and Writing Standards

Reading Standards:

- **RI.4.1:** Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences.
- **RI.4.2:** Determine the main idea of a text and explain how it is supported by key details; summarize the text.
- **RI.4.7:** Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, timelines) and explain how the information contributes to an understanding of the text.

Writing Standards:

- **W.4.1:** Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
- **W.4.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- **W.4.4:** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

- **W.4.5:** Develop and strengthen writing as needed by planning, revising, and editing.

Culturally Responsive Assessment of Indigenous Schooling Principles:

Relationality, relationships, and communities

1. Encourages students to understand themselves within broader communities

2. Relationships within and among local/regional Indigenous community are understood and/or reflected.
3. Encourages students to build and sustain relationships
4. Relationship within the classroom are strong

Materials Needed:

- 3D pens and filament
- 3D printer
- Computers or tablets with Internet access for Tinkercad
- Art supplies (colorful paper, markers, etc.)
- Multimedia resources (videos showcasing different cultures, images of cultural artifacts)
- Reflection journals for personal insights
- Exit ticket templates
- Tactile 3D-printed or 3D pen templates of letters and words for students with writing reversals.

Safety Measures for 3D Pens:

1. **Supervision:** Always supervise students while using 3D pens.
2. **Heat Awareness:** Explain that the tip of the pen gets very hot; students should never touch it.
3. **Workspace:** Use a designated area with non-flammable materials and a clear surface.
4. **Proper Handling:** Teach students how to hold the pen correctly to avoid accidents.

Here's a detailed lesson plan incorporating AVID strategies, guide questions, and activities for 3rd and 4th graders, focusing on culture, 3D design, and 3D pens.

Week 1: Introduction to Culture and 3D Design

Goals:

- Understand the concept of culture and its significance.
- Learn how to navigate Tinkercad and create basic shapes.
- Practice safe handling of 3D pens.
- For students with writing reversals**:** Begin practicing proper letter formation using tactile 3D pen tracing.

Arizona State Standards:

- 3rd Grade:
  - W.3.2: Write informative/explanatory texts to examine a topic and convey ideas clearly.
  - W.3.4: With guidance, produce writing appropriate to the task and purpose.
- 4th Grade:

- W.4.2: Write informative/explanatory texts to examine a topic and convey ideas clearly.
- W.4.4: Produce clear and coherent writing appropriate to the task, purpose, and audience.

Day 1: Introduction to Culture

- Objective: Students will define culture and identify cultural artifacts.
- Materials:
  - Images and videos showcasing different cultures.
  - Chart paper or whiteboard.
  - Markers.
  - Reflection journals.
- Activities:

0. **Discussion (10 minutes):**
   - AVID Strategy: Think-Pair-Share [1]
   - Pose the question: "What is culture?"
   - Students think individually (2 minutes), pair with a partner to discuss (3 minutes), and then share with the whole class (5 minutes).
   - Guide Questions:
     - What are some things that make your family unique?
     - What traditions do you celebrate?
     - What is something you are proud of about where you come from?
1. **Visual Presentation (10 minutes):**
   - Show images and short video clips of various cultural artifacts, clothing, food, music, and traditions.
   - Example Video Link: Search on YouTube for "cultural diversity for kids" or "Introduction to different cultures"
   - Guide Questions:
     - What did you notice about the different types of clothing?
     - What types of celebrations did you see?
     - What are some similarities and differences between the cultures you saw?
2. **Small Group Reflection (5 minutes):**
   - AVID Strategy: Carousel Brainstorming [1]
   - Divide students into small groups.
   - Each group discusses one artifact that stood out to them and why.
   - Groups write their ideas on chart paper.
   - Guide Questions:
     - Why did this artifact stand out to you?
     - What does it tell you about the culture it comes from?
     - How is it similar to or different from things in your own culture?
3. **Exit Ticket (5 minutes):**
   - "Write one new thing you learned about culture today."
   - AVID Strategy: Quick Write [2]

- Differentiated Activities:

    - Sensory Difficulties: Provide fidget tools or a quiet corner.
    - Short Attention Span: Use shorter video clips and frequent movement breaks.
    - One-on-One Prompts: Pair with a teacher or aide for support.
    - Provide tactile 3D-printed or pen-created letter templates for students to trace while reflecting in their journals.

Day 2: Introduction to Tinkercad

- Objective: Students will create Tinkercad accounts and learn basic navigation and shape creation.
- Materials:
    - Computers or tablets with internet access.
    - Tinkercad website: tinkercad.com
    - Tinkercad tutorial video for kids: Search on YouTube for "Tinkercad basics for kids" [3][4]
- Activities:

    0. **Account Creation (5 minutes):**
        - Guide students in creating Tinkercad accounts.
    1. **Navigation (10 minutes):**
        - Demonstrate the Tinkercad interface, including the workplane, shape library, and basic tools (select, move, resize).
        - Guide Questions:
            - How do you move the workplane around?
            - Where do you find the shapes?
            - How do you select an object?
    2. **Shape Creation (10 minutes):**
        - Students create a simple shape (e.g., a cube or sphere) and modify its size, color, and position.

    Activity Addition for Writing Reversals:

        - Students trace their names or simple words in Tinkercad to practice spatial recognition of letters
        - Guide Questions:
            - How can you change the size of your shape?
            - How can you change the color?
            - How can you move your shape to a different spot?
    3. **Exit Ticket (5 minutes):**
        - "Write what shape you want to create in Tinkercad next time."
        - AVID Strategy: Metacognitive Journal [2]
- Differentiated Activities:

    - Sensory Difficulties: Use noise-canceling headphones.

- Short Attention Span: Break tasks into smaller steps with frequent check-ins.
- One-on-One Prompts: Provide direct assistance.

Day 3: Designing a Simple Cultural Artifact

- Objective: Students will design a simple cultural artifact in Tinkercad.
- Materials:
  - Computers or tablets with Tinkercad access.
  - List of cultural artifacts discussed on Day 1.
  - Step-by-step design instructions (written or visual).
- Activities:

0. **Artifact Discussion (5 minutes):**
   - Review the cultural artifacts discussed previously.
   - Guide Questions:
     - What artifacts do you remember from our discussion on Monday?
     - Which artifact are you most interested in designing?
1. **Design Instructions (10 minutes):**
   - Provide step-by-step instructions on designing a simple cultural artifact (e.g., a simple mask, a pot, or a small building).
   - Example: "Today, we will design a simple pot. First, drag a cylinder onto the workplane. Then, drag a smaller cylinder and turn it into a 'hole'. Place the hole inside the larger cylinder to create the inside of the pot."
2. **Hands-On Design (10 minutes):**
   - Students begin designing their artifacts in Tinkercad, following the instructions.
   - Guide Questions:
     - What shapes are you using to create your artifact?
     - How are you changing the shapes to make them look like the real artifact?
3. **Exit Ticket (5 minutes):**
   - "Write what cultural artifact you are designing in Tinkercad."
   - AVID Strategy: Cornell Notes [1][2] - Students can take notes on the design process.

- Differentiated Activities:
  - Sensory Difficulties: Allow students to work in a quiet space.
  - Short Attention Span: Use timers for focused sessions.
  - One-on-One Prompts: Offer constant feedback during the design phase.

Day 4: Introduction to 3D Pens

- Objective: Students will learn about 3D pens and practice safe handling and basic drawing techniques.
- Materials:
    - 3D pens and filament.
    - Non-flammable work surfaces.
    - Safety goggles.
    - Ice packs or cool water (for emergencies).
    - 3D pen safety video for kids: Search on YouTube for "3D pen for kids safety" [5][6]
- Activities:

    0. **3D Pen Overview (5 minutes):**
        - Introduce the 3D pen and explain safety guidelines.
        - Guide Questions:
            - What do you know about 3D pens?
            - Why do we need to be careful when using them?
    1. **Demonstration (10 minutes):**
        - Show how to use the pen safely and effectively, including loading filament, controlling speed, and avoiding touching the hot tip.
    2. **Hands-On Practice (10 minutes):**
        - Students practice drawing simple shapes (lines, circles, squares) on a non-flammable surface.

        Activity Addition for Writing Reversals:

        - Provide tactile templates of commonly reversed letters (e.g., b/d, p/q) for students to trace using 3D pens.

        - Guide Questions:
            - How does the speed of the pen affect your drawing?
            - How can you make your lines straight?
    3. **Exit Ticket (5 minutes):**
        - "Write what technique you found most interesting with the 3D pen."
        - AVID Strategy: Reflective Journal [2]
- Differentiated Activities:

    - Sensory Difficulties: Allow breaks if overwhelmed.
    - Short Attention Span: Provide short, clear instructions.
    - One-on-One Prompts: Work closely with students needing help managing the pen.

Week 2: Developing Designs

Goals:

- Refine cultural artifact designs using Tinkercad.
- Collaborate with peers to share cultural stories.
- Prepare designs for 3D printing.
- For students with writing reversals: Reinforce proper letter formation by tracing cultural words and phrases with 3D pens.

Arizona State Standards:

- 3rd Grade:
  - W.3.5: Develop and strengthen writing as needed by planning, revising, and editing.
  - W.3.2: Write informative/explanatory texts to examine a topic and convey ideas clearly.
- 4th Grade:
  - W.4.5: Develop and strengthen writing as needed by planning, revising, and editing.
  - W.4.2: Write informative/explanatory texts to examine a topic and convey ideas clearly.

Day 5: Refining Tinkercad Designs

- Objective: Students will refine their Tinkercad designs based on peer feedback.
- Materials:
  - Computers or tablets with Tinkercad access.
- Activities:

0. **Peer Feedback Session (10 minutes):**
   - AVID Strategy: Think-Pair-Share [1]
   - In pairs, students share their Tinkercad designs and provide constructive feedback.
   - Guide Questions for Feedback:
     - What is one thing you like about your partner's design?
     - What is one thing your partner could improve?
     - Does the design look like the cultural artifact it's supposed to be?
1. **Refinement Time (15 minutes):**
   - Students make adjustments to their designs based on the feedback they received.
2. **Exit Ticket (5 minutes):**
   - "Write what feedback you received about your design and what changes you made."
   - AVID Strategy: Problem-Solution Journal [2]

- Differentiated Activities:
  - Sensory Difficulties: Provide a calming corner for breaks.
  - Short Attention Span: Set short intervals for focused work.
  - One-on-One Prompts: Assist students in articulating feedback.

- Students with writing reversals trace their design-related words using 3D pens, combining tactile and motor skills.
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Day 6: Group Work on Cultural Stories

- Objective: Students will share cultural stories in groups and reflect on their importance.
- Materials:
  - Reflection journals.
- Activities:

0. **Group Discussion (5 minutes):**
   - Discuss the importance of storytelling in preserving and sharing culture.
   - Guide Questions:
     - Why are stories important?
     - How do stories help us learn about different cultures?
1. **Sharing Stories (15 minutes):**
   - In groups, students share cultural stories from their families or communities.
   - AVID Strategy: Character Corners [1] - Students can take on the role of a character in their story.
   - Guide Questions:
     - What is the main message of your story?
     - What does your story teach us about your culture?
2. **Group Reflection (5 minutes):**
   - Each group shares one interesting story with the class.
3. **Exit Ticket (5 minutes):**
   - "Write what story you shared with your group and what you learned from it."
   - AVID Strategy: Dialectical Journal [2]

- Differentiated Activities:

  - Sensory Difficulties: Provide visual aids.
  - Short Attention Span: Use a talking stick for focused sharing.
  - One-on-One Prompts: Support students in organizing their thoughts.
  - During group sharing, students with writing reversals use 3D-pen-created letter cards as prompts for their storytelling.

Day 7: Printing Designs Preparation

- Objective: Students will prepare their Tinkercad designs for 3D printing.
- Materials:
  - Computers or tablets with Tinkercad access.
  - Checklist of adjustments needed for printing (e.g., size, orientation, support structures).
- Activities:

0. **Preparation Guide (5 minutes):**
    - Discuss adjustments needed for successful 3D printing.
    - Guide Questions:
        - What size should your design be for printing?
        - Does your design need any extra support to print correctly?
1. **Adjusting Designs (15 minutes):**
    - Students make necessary adjustments to their designs in Tinkercad.
2. **Exit Ticket (5 minutes):**
    - "Write how you prepared your design for printing."
    - AVID Strategy: Speculation-Prediction Journal [2] - Students predict how their design will print.

- Differentiated Activities:

    - Sensory Difficulties: Allow students to work in quieter areas.
    - Short Attention Span: Provide visual checklists.
    - One-on-One Prompts: Guide students through the preparation process.

Day 8: 3D Printing Session

- Objective: Students will begin printing selected designs and observe the 3D printing process.
- Materials:
    - 3D printer.
    - Filament.
    - Tools for removing prints from the build plate.
- Activities:

    0. **Printing Overview (5 minutes):**
        - Explain the 3D printing process, including how the printer builds the object layer by layer.
        - Guide Questions:
            - How does the 3D printer create the object?
            - What is filament?
    1. **Printing Activity (20 minutes):**
        - Begin printing selected designs.
        - Students observe the printing process.
    2. **Exit Ticket (5 minutes):**
        - "Write what you are excited to see printed from your design."
        - AVID Strategy: Sensory Moment in Time [2] - Students describe what they see, hear, and smell during the printing process.
- Differentiated Activities:

    - Sensory Difficulties: Allow students to step away if overwhelmed by the noise.
    - Short Attention Span: Keep the printing activity brief and engaging.
    - One-on-One Prompts: Provide hands-on support during setup.

Weeks 3-4: Refinement and Collaboration

Goals:

- Refine cultural stories and 3D designs.
- Begin using 3D pens to bring designs to life.
- Collaborate with peers to enhance projects.
- For students with writing reversals**:** Practice tracing and writing full sentences using 3D pens.

Arizona State Standards:

- 3rd Grade:
  - W.3.1: Write opinion pieces supporting a point of view with reasons.
  - W.3.4: Produce writing appropriate to the task and purpose.
- 4th Grade:
  - W.4.1: Write opinion pieces supporting a point of view with reasons and information.
  - W.4.4: Produce clear and coherent writing appropriate to the task, purpose, and audience.

Activities:

- Story Refinement: Students revise cultural stories with peer feedback.
  - AVID Strategy: Reciprocal Teaching [2]
- 3D Pen Design: Use 3D pens to recreate elements of their artifacts.
- Group Collaboration: Work in groups to prepare for presentations.
  - AVID Strategy: Inner-Outer Circle [2]

Addition for Writing Reversals:

- Students create tactile sentence structures using 3D pens, especially focusing on commonly reversed letters

Weeks 5-8: Project Development and Presentation

Goals:

- Finalize cultural artifact designs and stories.
- Practice and refine presentations.
- Showcase projects in a final exhibit.
- **For students with writing reversals:** Demonstrate improvement in writing confidence and letter formation through tactile 3D pen activities.

Arizona State Standards:

- 3rd Grade:
  - W.3.2: Write informative texts to explain their cultural artifact designs.
  - W.3.5: Revise and strengthen writing as needed by planning, revising, and editing.
- 4th Grade:
  - W.4.2: Write informative texts to explain their cultural artifact designs.
  - W.4.5: Develop and strengthen writing by revising and editing.

Sample Activities:

- Weeks 5-6:
  - Finalize 3D printed designs.
  - Rehearse presentations.
  - Write summaries of cultural artifacts and their personal significance.
  - AVID Strategy: Write from Different Perspectives [2]
- Weeks 7-8:
  - Prepare for the final exhibit.
  - Present projects, share cultural stories, and showcase 3D models.
  - AVID Strategy: Socratic Seminar [2]

Final Exhibit:

- Students showcase their artifacts, share cultural stories, and demonstrate how they used Tinkercad and 3D pens.
- Students display their 3D-pen-created words alongside their cultural artifacts, showing their learning journey.
- **A**VID Strategy: OPTIC for Visual Analysis [2] - Students analyze their own and others' projects.

Assessment Rubrics for Writing and 3D Output

Below are detailed rubrics tailored to assess students' writing (cultural stories and reflections) and their 3D outputs (Tinkercad designs and 3D pen creations).

Writing Assessment Rubric

Criteria:

1. Content and Ideas (40%)
2. Organization (20%)
3. Conventions (20%)
4. Voice and Creativity (10%)
5. Effort and Completion (10%)

Criteria	Exemplary (4)	Proficient (3)	Developing (2)	Needs Improvement (1)
Content and Ideas	Includes rich, detailed, and accurate information about the cultural artifact and its significance.	Includes accurate information with sufficient details about the cultural artifact.	Includes some information about the cultural artifact, but details are vague or incomplete.	Minimal or inaccurate information; lacks clarity or connection to the artifact.
Organization	Writing is logically organized with a clear introduction, body, and conclusion.	Writing is organized but may lack smooth transitions between ideas.	Writing has some organization but may be confusing or lack a clear structure.	Writing is disorganized, making it difficult to follow.
Conventions	Few to no grammar, spelling, or punctuation errors.	Minor grammar, spelling, or punctuation errors that do not affect understanding.	Frequent grammar, spelling, or punctuation errors that somewhat affect understanding.	Significant errors in grammar, spelling, or punctuation, making it difficult to understand.
Voice and Creativity	Writing is engaging, shows personal voice, and reflects creativity.	Writing shows some personal voice and effort in creativity.	Writing shows limited personal voice and creativity.	Writing is flat, lacks effort, and does not show personal voice or creativity.
Effort and Completion	Completed writing on time with great effort; exceeds expectations.	Completed writing on time with sufficient effort; meets expectations.	Writing is incomplete or appears rushed, showing minimal effort.	Writing is incomplete and shows little to no effort.

3D Output Assessment Rubric

Criteria:

1. Design Creativity and Cultural Representation (40%)
2. Technical Skill (20%)
3. Attention to Detail (20%)
4. Effort and Perseverance (10%)
5. Presentation and Sharing (10%)

Criteria	Exemplary (4)	Proficient (3)	Developing (2)	Needs Improvement (1)
Design Creativity and Cultural Representation	Artifact is highly creative, detailed, and accurately represents the chosen culture; reflects deep thought.	Artifact is creative and represents the chosen culture accurately with sufficient detail.	Artifact shows some creativity and cultural representation but lacks depth or detail.	Artifact shows little creativity or cultural representation; lacks connection to the culture.
Technical Skill	Demonstrates advanced use of Tinkercad tools and/or 3D pen techniques; artifact is technically well-executed.	Demonstrates sufficient use of Tinkercad tools and/or 3D pen techniques; artifact is functional.	Demonstrates basic understanding of Tinkercad tools or 3D pen techniques; artifact is incomplete.	Has difficulty using Tinkercad tools or 3D pens; artifact is incomplete or poorly executed.
Attention to Detail	Artifact is polished with excellent attention to detail (e.g., smooth edges, accurate proportions).	Artifact is mostly polished with sufficient attention to detail.	Artifact is somewhat polished but shows inconsistencies in detail (e.g., rough edges).	Artifact lacks attention to detail and appears rushed or unfinished.
Effort and Perseverance	Displayed great effort and overcame challenges during the design and creation process; went above expectations.	Displayed effort and handled challenges sufficiently; met expectations.	Displayed minimal effort or struggled with challenges without seeking solutions.	Displayed little effort or gave up easily when faced with challenges.
Presentation and Sharing	Artifact is presented with enthusiasm, clear explanation, and connection to the culture; engages the audience.	Artifact is presented with sufficient explanation and connection to the culture.	Presentation is somewhat unclear or lacks connection to the culture.	Presentation is unclear, rushed, or lacks explanation and connection to the culture.

Scoring System

1. **Writing Rubric:**
    - Total Points = 20
    - Grade Conversion:

        - 18-20: Exemplary
        - 15-17: Proficient
        - 10-14: Developing
        - Below 10: Needs Improvement
2. **3D Output Rubric:**
    - Total Points = 20
    - Grade Conversion:
        - 18-20: Exemplary
        - 15-17: Proficient
        - 10-14: Developing
        - Below 10: Needs Improvement

Assessment Implementation

1. **Writing Assessment:**
    - Collect students' cultural stories, reflections, and exit tickets.
    - Use the rubric to evaluate for content, organization, conventions, creativity, and effort.
2. **3D Output Assessment:**
    - Observe students during the design and creation process to assess effort and technical skills.
    - Evaluate the final artifact for creativity, detail, and cultural representation.
    - Assess their presentation during the final exhibit for clarity and engagement.

Resources:

1. AVID Strategies Carousel Brainstorming Ideas gathered quickly, topic written as headings on chart paper. Students divided into g - Seattle Public Schools

2. AVID STRATEGIES - gccisd
3. Tinkercad Basics for Kids | Navigating the Tools - YouTube
4. Tinkercad Basics for Kids - YouTube
5. Best 3D Printing Pen for Kids! | Safe, Fun & Educational STEM Toy! - YouTube
6. How to use 3D Pen for Kids - myFirst 3dPen Make - YouTube

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