Social Studies and the Young Learner 36 (2) pp. 3–10

Do You Know What an Archaeologist Does? Exploring Cultural Heritage in Real-World and Digital Contexts

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After a few months of discussing cultural heritage, ancient artifacts, and present-day tools, the children were on their way to the 3D lab! The children brought artifacts to scan. The family chaperones were very curious about the lab as well after hearing their children talk about their project. Dr. Harrison knew the children would want to explore their surroundings first, so she gave them all a few minutes to walk around and see all the different 3D scanners in the room. Then, Dr. Harrison called them together to show them the Artec Space Spider and began to scan a banana that one of the children brought.

What are you doing? – Cade

So, this scanner is taking some measurements of the banana. I need to scan all around to measure the whole banana. – Dr. Harrison

I can see it on the TV! – Layla

What do you use to measure things in your classroom? – Dr. Harrison

A ruler! – Henry

This scanner here scans the object into a bunch of tiny dots to get more detailed measurements. The measurement shows up on the computer, then the computer can print the 3D object. Does anyone know how the scanned objects get to the computer and then to the printer? – Dr. Harrison

The children did not have an answer to that question, so we started to investigate the scanner to find out.

What are these? – Dr. Harrison, pointing to the electrical cords.

They have electricity in them! – Henry

Yes, electrical cords give everything power. – Dr. Harrison

How many cords do you see? – Ms. Cassandra (Teacher)

Two! – Children

And what are the cords connected to? – Dr. Harrison

The tv! There is another cord that goes into the screen. – Layla

The children watch as the scanner continues to take measurements and prepare to print the 3D replica of the banana. They are mesmerized by what is taking place before their eyes. Once the banana begins to print, the children explore the other types of scanners in the room.

The children in the 4-year-old classroom showed a great deal of interest in discussing their family traditions and heritage with the teachers and each other. The school is dedicated to utilizing the project approach as a framework to enact the curriculum through real-world experiences relevant to young children. The Project Approach is an inquiry approach to learning where children investigate topics in-depth across three distinct phases.[1] A strong emphasis is placed on authentic contextualized social studies as a foundation for learning.

The Heritage Project highlights the value of engaging with high-level concepts of digital heritage from an early age. Teachers can explore heritage within their own classrooms by combining local resources such as field experts, 3D prints, online collections, and local arts (Chart 1). The teachers had the opportunity to partner with Dr. Harrison (second author), an Assistant Professor and Director of a 3D lab. Dr. Harrison is an anthropologically trained archaeologist who utilizes advanced digital technologies to enhance public understanding of cultural heritage.

Chart 1.

The anthropological study of heritage—our inherited culture, traditions, monuments, and objects—aligns with early childhood social studies standards.[2] Technology is now central to our understanding of heritage, with recent developments in digital imaging, 3D virtualization, and 3D printing enabling new (non-specialist) audiences to view and engage with archaeological sites, artifacts, and material culture. Educators have been reluctant to incorporate immersive and interactive digital technologies into the preschool classroom because of a preconception that young learners are unable to meaningfully engage with such tools—and that these approaches amount to "technological fetishism."[3] This is reflected in the absence of technology standards in the C3 framework; however, technology does appear within the social studies strand in some recent state standards (e.g., Florida Early Learning Standards). "Technologies, when used in a playful way and integrated into early years pedagogies as 'tools' rather than distinct and different objects…provide opportunities for creativity."[4]

Incorporating concepts and methods from digital heritage (e.g., digital storytelling, 3D visualization, 3D printing) enlivens the social studies curriculum and provides novel contexts for children to engage in meaningful co-creation. Archaeology is an inherently visual discipline, and using technology to visualize artifacts and sites makes archaeology more accessible to young children. These lessons engage the senses while providing a deeper understanding of how cultures change and develop over time. Consequently, digital technologies enhance and deepen understanding of social studies content—an area of the curriculum that is often presented in stale and even stereotypical ways.

Bringing Cultural Heritage to Life with Real World Experiences

Interacting with a Field Expert

Collaborating with a field expert presented an opportunity to teach social studies in a meaningful way and reinforce that archaeology is not treasure-hunting but rather the scientific study of prehistory and history through excavation and artifact analysis. The first lesson began with an introduction to a Bronze Age archaeological site in Turkey, Seyitömer Höyük, which is notable for its extensive and fully preserved pottery workshop (see Table 1). Dr. Harrison utilized photographs and 3D reconstructions of clay mixing areas and kilns at the archaeological site as a prompt for dialogue. The conversation was semi-structured to build awareness and understanding of the role of archaeologists in studying past cultures and the way that technologies shape daily life (in the past and present).

> *Do you know what an archaeologist does?* – Dr. Harrison
>
> *Discover things!* – Tianna
>
> *Discovering black holes!* – Eli
>
> *Archaeologists find old things and tell stories about them.* – Dr. Harrison

Dr. Harrison shows the children a picture of a clay mixer from an archeological site.

> *Is this a volcano?* – Eli
> *This is an old mixing bowl to make clay.* – Dr. Harrison
> *How is it outside?* – Micah
> *Because they used to work outside.* – Dr. Harrison
> *Like when dinosaurs were alive?* – Trevor

Table 1. **Lesson Plan: Interacting with a Field Expert**

Teacher Objectives	Create a baseline understanding of archaeology as a scientific discipline. Learn what an archaeologist does. Understand the evolution of technology over time. Discover how archaeologists are using digital technologies.
Lesson Description	**Part 1:** Field expert explains archaeology with visualizations of artifacts and sites and explains how artifacts were found in situ and are now visible on a digital screen due to 3D scanning. **Part 2:**Children converse with field expert and gain a deeper understanding of archaeological cultures.
C3 Framework (by the end of Grade 2)	**D2.His.1.K-2.** Create a chronological sequence of multiple events. **D2.His.2.K-2.** Compare life in the past to life today. **D2.Geo.2.K-2.** Use maps, graphs, photographs, and other representations to describe places and the relationships and interactions that shape them. **D2.His.4.K-2.** Compare perspectives of people in the past to those of people in the present.
Florida Early Learning Standards	**FELS.VII.A.4.** Culture: Explores cultural attributes by comparing & contrasting different characteristics. **FELS.VII.E.1.** Time, Continuity and Change: Identifies changes within a sequence of events to establish a sense of order and time. **FELS.VII.H.1.** Technology and Our World: Uses and shows awareness of technology and its impact on how people live.
Children's Deliverables	Anecdotal records from teachers of children's words Learning web
Scaffolding	Children participate in group conversations with the teacher and field expert. Children view visualizations of archaeological sites and artifacts.
Guiding Questions	Do you know what an archaeologist does? What do you think this artifact was used for? Where do you think artifacts come from? How do you think archaeologists figure out how old something is? Does this artifact look like anything in your household today?
Resources	**https://sketchfab.com/access3d/collections** **https://3d.si.edu/**

The conversation then focused on ancient pottery production. Dr. Harrison led students through a dialogue showing photographs and 3D scans of an archaeological pottery kiln on a Promethean panel. The students were shown images of semi-spherical molds used to shape clay and mass-produce bowls, a landmark technological innovation for the time.

Dr. Harrison shows a picture of molding rock used to shape the clay into a bowl.

It is a rock! And it is breaking out of clay. – Cade
It is a mold. – Dr. Harrison
A mold is something you mold into something, like an ice tray. – Levi

Dr. Harrison showed a photograph of an old pottery kiln and asked what they thought.

A pool! – Ava
It is a site where they are digging. – Dr. Harrison
An oven to cook a gingerbread man. – Trevor
Or a pot! – Mitchell
Yes! You can make a pot or a bowl and then you can use it to eat. – Dr. Harrison
And these are some objects that we found. What are these? – Dr. Harrison
Those are pots! – Ava
Different sizes. – Children
Some of them are painted. – Henry
Why do they look different? – Dr. Harrison
That one is the oldest. – Cade

After learning about archaeology and artifacts, students were shown a fictional comic about archaeology. The comic, called *Mix, Mold, Fire!* features the (mis)adventures of Abby the Apprentice, a young girl who learns how to make pottery in a Bronze Age workshop (see Figure 1). The comic's action sequence is based on real archaeological excavations at Seyitömer Höyük and illustrations based on the photographs of kilns, workshops, and artifacts found at the site.

I want to read you a story that includes a pot like the one you see here. – Dr. Harrison
What type of story is this? – Dr. Harrison
It is a comic! – Micah
A funny story. – Stefan

While Dr. Harrison is reading the comic the children are commenting:

Figure 1. **The action sequence in the "Mix, Mold, Fire!" comic provides an example of how objects from the past can inspire narrative storytelling. *Abby the Apprentice* in "Mix, Mold, Fire!" Copyright 2018 by Kristin Donner. All rights reserved.**

She is mixing it now. – River
This is just the rock mold we saw before. – Dr. Harrison
She is going to put the clay on it. – Micah
She makes a double pot! – Cade
What do you do with that pot? – Levi
Now they are putting it into the fire. Do you know why? – Dr. Harrison
To burn the clay? – Micah
To make it strong. – Trevor

The comic reinforces previous discussions about ancient pottery and introduces the concept of narrative sequencing. Next, the teachers prompted the students to author their own comics. The teachers used this exercise to gauge children's understanding of culture (archaeology) and technology (material culture/objects).

Exploring Storytelling Through Comics

A digital collection of over one hundred 3D scanned artifacts were displayed on the Promethean board, and children took turns spinning and manipulating the 3D scans of artifacts from cultures around the world. Each child chose a unique object as inspiration for their comic story and shared them with the class (see Table 2).

Trevor's comic demonstrates comprehension of the lesson's lead-in material (concepts of time and the concept of archaeological excavations). His story begins with a drawing that shows a buried artifact. The artifacts spring to life and go on an adventure. The story concludes with the discarded artifact, discovered by an archaeologist from the future.

Annie's comic displays an understanding of the interrelationships between culture, time, and technology. Her story explores cultural issues by focusing on how a music box wanted to save the planet from being so dirty. She reveals an understanding of technology by talking about how the music box had to be wired up to play music. The problem-solution arc of the story indicates understanding of time, continuity, and change.

Layla's comic is a search-and-rescue-themed story about a group of "bunny girls" rescuing a magical music box from an adult. The story indicates an understanding of causality (bunny girls using a mask to scare the adult), and the different characteristics of music (the music box plays a "happy song") once it is set free.

The children created comics that incorporated real artifacts from the past, demonstrating an understanding of the passage of time and the role of an archaeologist. These comics revealed the degree to which children understood social studies in context.

Connecting Past and Present

Through work samples, the teachers knew the children had a basic understanding of the role of technology in shaping culture and were familiar with interpreting and creating visual stories. The teachers wanted the children to take a deeper dive into how new technology impacts our knowledge of material culture (e.g., objects, artifacts) from the past and the present (see Table 3). The students explored artifacts including music boxes, pottery, and other tools used in the past. The children observed that some of these objects are still in use but look different today. Many of the artifacts involved cooking pots, utensils, and dishes, which got children talking about various foods eaten around the world.

Table 2. **Lesson Plan: Exploring Storytelling Through Comics**

Teacher Objectives	Expand lateral thinking by connecting *Learning Archaeology in Context* lesson to visual representation of archaeology through comics. Assess children's understanding of archaeology by examining their stories.
Lesson Description	**Part 1:** Field expert shares comic based on archaeological site introduced in *Learning Archaeology in Context* lesson. **Part 2:** Children create their own comic based on an object from the past chosen from an online 3D archive of artifacts.
C3 Framework (by the end of Grade 2)	**D2.His.4.K-2.** Compare perspectives of people in the past to those of people in the present. **D2.His.14.K-2.** Generate possible reasons for an event or development in the past. **D2.His.10.K-2.** Explain how historical sources can be used to study the past.
Florida Early Learning Standards	**FELS.VII.F.1.** Governance, Civic Ideals and Practices: Recognizes and follows rules and expectations in varying settings. **FELS.VII.F.2.** Governance, Civic Ideals and Practices: Participates in problem solving and decision making. **FELS.VII.H1.** Technology and Our World. Uses and shows awareness of technology and its impact on how people live.
Children's Deliverables	Each student creates a comic; children present comics to class.
Scaffolding	Children search through online archive of 3D models with teacher support. Children select an artifact of interest to base their comic on. Teachers support children creating their comic grid.
Guiding Questions	Who made your artifact? What did you see when you spun your 3D model around on the screen? What was your artifact used for? Why did you choose this artifact? What actions will happen to this artifact in your comic? Who will interact with this artifact in your comic? When does your comic occur? Is your artifact still used today? What is the chain of events in your comic?
Resources	**https://sketchfab.com/access3d/collections** **https://opencontext.org/query/?q=seyitomer#tab=0/ovgrd=oc/zm=11/lat=39.5040/lng=29.7070/ov=sqr**

The teachers and children noted the cultural specificity of food preparation traditions across geographical regions. They discussed the heritage of food traditions across cultures, kinship, and family structures embedded in food preparation and consumption. Children personalized their understanding of the culture of food through family involvement. Children wanted to incorporate their home food traditions into a marketplace in their dramatic play center but couldn't use fresh foods. The 3D-printed foods created an opportunity to connect technology and culture in the classroom.

Technology and Our World

Work samples revealed some gaps in children's understanding of cultural heritage. For example, one child believed that an office printer could produce full-color, 3D-printed objects such as fruit. The children placed an orange on the flatbed of a standard printer and were surprised to learn that the image produced was flat.

> *I don't want it to get smooshed when you close the top of the printer! It is my lunch; I can't eat it when it is flat.* – Elias

The children eagerly watched as the copy was created.

It is the same! – Elias
It is not the same (she flips the paper over to look at the other side), wait... – Penelope
Look, it is the same color, and they look the same. – River

It is not 3D. – Penelope
If it is not 3D, what is it? – Ms. Cassandra
Flat. – River
2D! – Penelope screamed

The teachers and Dr. Harrison knew that having the students at the 3D lab would improve their understanding of technology, by highlighting the boundary between the physical and the digital world (see Table 4). Together, the teaching team carefully synthesized the children's understanding and devised a lesson that would engage children with the process of 3D laser scanning a physical object and creating a digital replica with 3D printing. This builds on children's interest in archaeology and cultural heritage artifacts from Dr. Harrison's earlier lesson. It also provided an opportunity for hands-on learning that emphasizes meaningful social interactions through engagement with technology.

Table 3. **Lesson Plan: Connecting Past and Present**

Teacher Objectives	Identify children's heritage, home country cultural practices and the artifacts/objects associated with those cultures. Increase children's competency in using a map to identify places. Expand children's understanding of the connection between food, culture, and geography.
Lesson Description	**Part 1:** Look at where children are from; look at artifacts and food cultures from children's homes. **Part 2:** Children locate places on the map. **Part 3:** Create a market representing the food cultures discussed in Part 1 and 2.
C3 Framework (by the end of Grade 2)	**D2.Geo.2.K-2.** Use maps, graphs, photographs, and other representations to describe places and the relationships and interactions that shape them. **D2.Geo.3.K-2.** Use maps, globes, and other simple geographic models to identify cultural and environmental characteristics of places. **D2.Geo.6.K-2.** Identify some cultural and environmental characteristics of specific places. **D2.Geo.11.K-2.** Explain how the consumption of products connects people to distant places.
Florida Early Learning Standards	**FELS.VII.A.3.** Culture: Explores culture of peers and families in the classroom and community. **FELS.VII.A.4.** Culture: Explores cultural attributes by comparing and contrasting different characteristics. **FELS.VII.D.2.** Spaces, Places and Environments: Identifies differences and similarities between own environment and other locations. **FELS.VII.D.5.** Spaces, Places and Environments: Recognizes some geographic tools and resources.
Children's Deliverables	Children identify places on a map. Children identify foods from their home culture.
Scaffolding	Teachers utilize different kinds of media to identify foods from particular regions and artifacts from these regions, with the support of families. Teachers support children in finding these locations on the map. Families share food and cooking implements from home with the class.
Guiding Questions	What foods to do you eat at home? What tools do you use to cook? With family support: What traditions does your family have around preparing food? Around eating? Here's where we are on the map. What country is your family from? Let's find that together on the map.

Visiting the 3D Lab

The children were each assigned jobs for their field visit to the 3D lab. Dr. Harrison showed them around the 3D lab and introduced them to different types of laser scanners (see Table 5). Then, Dr. Harrison 3D-scanned a banana with a handheld Artec Space Spider structured light scanner. Structured light scanners rapidly measure the surface geometry of solid objects with a combination of projected light patterns and a camera. The banana was placed on a turntable that rotated as Dr. Harrison swept the scanner from side to side. This rotational and lateral movement captured the full 3D geometry of the banana, and the results were displayed in real-time on an 84" screen. With the help of the interactive visualization panel (similar to a Smart Board), students saw how measurements could be taken from anywhere on the object, digitally. Children

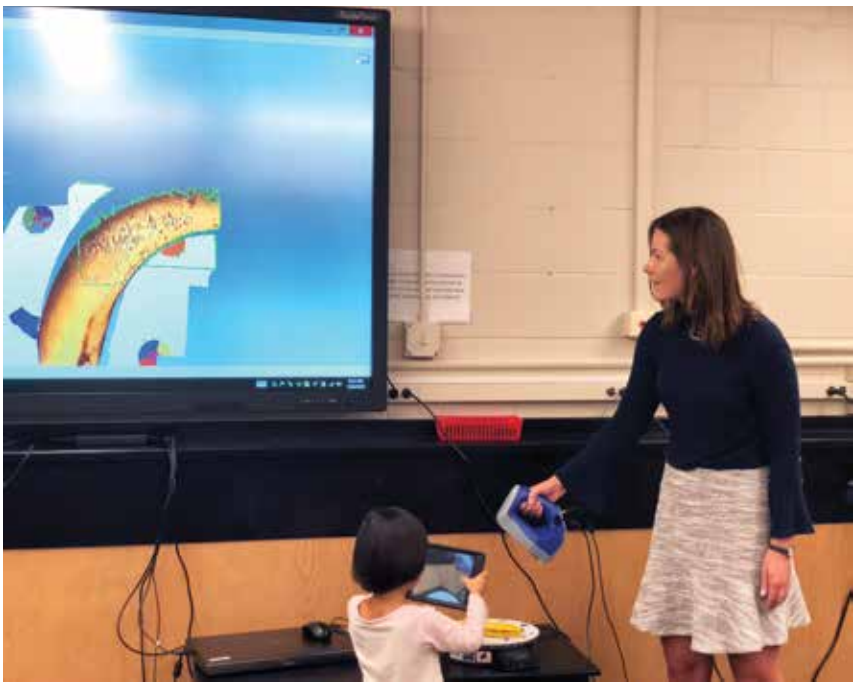

Figure 2. Dr. Harrison 3D scanning a banana with the Artec Space spider. The 3D scans were immediately displayed on the Promethean screen in real time, allowing children to grasp the concept of virtualization at an early age.

Table 4. **Lesson Plan: Technology and Our World**

Teacher Objectives	Support children in their inquiry to create food using technology. Follow children's lead to try to create 2D food with a copy machine. Encourage children to problem solve with technology and learn from the experience.
Lesson Description	Students wanted to create a market with foods from their own home culture. They couldn't use fresh foods, so they had to find a way to make a digital replica of a food. They tried using a copy machine to create images of food for their market.
C3 Framework (by the end of Grade 2)	**D2.Civ.11.K-2.** Explain how people can work together to make decisions in the classroom. **D2.Eco.2.K-2.** Identify the benefits and costs of making various personal decisions. **D2.Eco.3.K-2.** Describe the skills and knowledge required to produce certain goods and services.
Florida Early Learning Standards	**FELS.VII.H.1.** Technology and Our World: Uses and shows awareness of technology and its impact on how people live. **FELS.VII.F.2.** Governance, Civic Ideals and Practices: Participates in problem solving & decision making. **FELS.VII.D.4.** Spaces, Places & Environments: Uses spatial words.
Children's Deliverables	2D paper copies of food Anecdotal records of children's words
Scaffolding	Teachers supporting children to use the copy machine. Teachers ask children why they think the field expert's 3D scans look different than the paper copies of their foods.
Guiding Questions	What food are you trying to make a copy of? What do you think will happen when we place your food on this scanner bed? Why do you think the food came out as a flat piece of paper?

Table 5. **Lesson Plan: Visiting the 3D Lab**

Teacher Objectives	Understand the connection between using a scanner and seeing a 3D model of an object. Explore different types of technology. Understand how archaeologists use technology like 3D scanners in excavations. Recall the visit to the 3D Lab through memory stories.
Lesson Description	Teachers, children, and families went to the 3D lab on campus. The field expert introduced them to different kinds of 3D scanners and 3D printers. Children placed food on a turntable, and the field expert scanned it. The field expert scanned children's hands and feet onto a live 3D screen. The 3D scans were displayed in real time on a large screen for everyone to see. Children explored the 3D lab and multiple scanners, screens, and 3D prints around the room.
C3 Framework (by the end of Grade 2)	**D2.Eco.1.K-2.** Explain how scarcity necessitates decision making. **D2.Civ.11.K-2.** Explain how people can work together to make decisions in the classroom. **D2.Eco.2.K-2.** Identify the benefits and costs of making various personal decisions. **D2.Eco.3.K-2.** Describe the skills and knowledge required to produce certain goods and services.
Florida Early Learning Standards	**FELS.VII.H.1.** Technology and Our World: Uses and shows awareness of technology and its impact on how people live. **FELS.VII.D.4.** Spaces, Places and Environments: Uses spatial words. **FELS.VII.D.1.** Spaces, Places and Environments: Identifies the relationship of personal space to surroundings.
Children's Deliverables	3D printed objects; photographs of children utilizing and engaging with scanners; anecdotal records of children's words during the field visit; children created memory stories of their visit.
Scaffolding	Field expert helps children handle technology and manipulate 3D models on screen. Field expert explains how the 3D scanner is an advanced kind of measurement device like a ruler.
Guiding Questions	Do you recognize the object on the screen? How do you think the object appeared on the screen? Why do you think we have to move the object? What do you think is going to happen when we turn the scanner on? Why might an archaeologist want to use something like this scanner? Why do you think this print is not flat like the other print?

were amazed to see how 3D scans are visible from any perspective and can be digitally turned around, even upside down.

After Dr. Harrison's demonstration, the children went around to the various stations with different 3D laser scanners and structured light scanners. The 3D lab team showed the children how to scan all types of items; a favorite was scanning their shoes and hands. The children (and adults) were fascinated to explore the variety of scanners—some of which were meant for smaller objects while others were meant for larger, more complex pieces. The children were particularly drawn to the 3D prints stationed around the room, working to create groupings and trade with each other for desired objects. 3D printing is a form of additive manufacturing in which 3D objects are created by layering thin layers of materials like plastics, resin, and composites to build complex shapes. The prints used in this lesson were made of PLA, a form of hard plastic that comes in many colors.

The children collaborated as they digitally manipulated 3D models on a Promethean touch table in the center of the lab. Some students documented the field visit with iPads, creating a real-time digital "field journal." The experiences in the 3D lab illustrated how 3D scanning and visualization technology bridges the gap between authentic artifacts and digital representation and highlighted how these tools are crucial for archaeologists as they strive to understand and preserve past cultures through careful analysis and documentation.

Once back in the classroom, the children shared their experiences. They were all very eager to discuss what they scanned and how the 3D scanners worked. The teachers allowed the children ample time to unpack their experiences. The children created memory stories of their field visit. Some children chose to represent their experience by creating 3D representations with blocks and recycled materials to create their own laser scanners. The teachers talked to the children about their creations and gave vivid details of scanner sensors and probes, including how they are used to create measurements. The visit to the 3D lab improved children's understanding of technology by increasing awareness of 3D virtualization and demonstrating practical applications such as creating authentic replicas of physical objects.

Concluding Thoughts

The goal of this project was to create a holistic and humanized approach to teaching cultural heritage in real-world and digital contexts. The teachers and Dr. Harrison explored cultural heritage and archaeology through digital visualization of artifacts, comic storytelling, food heritage, and 3D scanning. By capturing children's words and collecting work samples, teachers gained a greater understanding of children's proficiency in utilizing digital tools in real-world contexts.

The compilation of lessons in the Heritage Project built an awareness of the time-depth of human cultures and fostered an understanding of the ways that material culture transforms and changes over time. Discussions with the field expert introduced children to interactive 3D visualizations of real archaeological sites. We drew on concepts of culturally responsive learning to develop lessons that incorporated home-to-school connections to encourage meaning-making around the heritage of food by creating 3D-printed foods in the dramatic play center. These efforts situated food in a cultural and geographical context where children engaged with maps to locate culinary traditions and provide a deeper understanding of the anthropology of food.

Technology was infused throughout the lessons from the start, emphasizing a fluid boundary between physical and digital learning. Technology served as a form of *translanguaging*, enabling preschoolers to communicate and understand advanced concepts by leveraging the sensory and visual properties of 3D scans and 3D prints. The Heritage Project demonstrates that preschoolers are capable of engaging with advanced technologies in significant ways and moving beyond cliché stereotypes (e.g., archaeology as treasure hunting, holidays around the world, and stereotypical foods). Providing children authentic real-world experiences with field experts in archaeology encouraged co-creation in the learning process, which in turn expanded their understanding of culture and technology in meaningful ways.

Notes

1. Lilian Gonshaw Katz and Sylvia C. Chard, *Engaging Children's Minds: The Project Approach*, 2nd ed. (Stamford, CT: Ablex Publishing, 2000).
2. Maria Economou, "Heritage in the Digital Age," in *A Companion to Heritage Studies*, ed. William Logan, Máiréad Nic Craith, and Ullrich Kockel (West Sussex, UK: Wiley Blackwell, 2015), 215–228.
3. Jeremy Huggett, "Archaeology and the New Technological Fetishism," *Archeologia e Calcolatori* 15 (2004): 81–92.
4. Lorna Arnott, Pauline Duncan, and Deirdre Grogan, "Creative and Dramatic Play with Technologies," in *Digital Technologies and Learning in the Early Years,* ed. Lorna Arnott (London: SAGE, 2017), 47–57.

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