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FROM THE GUEST EDITOR

A Tale of Technology and Collaboration: Preparing for 21st-Century Museum Visitors

Allyson Mitchell, Sarah Linn and Hitomi Yoshida

ABSTRACT

As younger generations become immersed in technology, museums and cultural institutions must create a familiar digital experience to cultivate connections with the 21st century visitor. Authors present an example of working with institutional content experts to create a digital outreach package that activates the museum's content to engage K-12 student groups in cognitive learning and prepare them for future museum visits. They identify methods for forging valuable, cross-departmental collaborations and highlight diverse learning approaches that capitalize on existing resources, expertise, and technology. **ARTICLE HISTORY**

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Synchronous, or live video chat technology, is increasingly accessible and regularly used in personal, educational, and professional environments. Developing interactive virtual learning (IVL) programming within cultural institutions increases audiences, expands the role of the educator, and can augment museum content that can be developed at little or no increased cost. Creating these programs necessitates vision, leadership, and teamwork, breaking down existing institutional silos and bringing together unique collaborative partners. Educational synchronous programs combine content and expertise to foster engagement with museums and encourage more enthusiastic, empathetic, and reflective museum visitors.

To illustrate how live virtual programming creates opportunities for institutional collaborations and deep learning experiences, we provide a detailed case study from the University of Pennsylvania Museum of Archaeology and Anthropology (Penn Museum).¹ The subsequent sections explore how existing resources – museum collections, content experts, educators, and technology – can be mobilized to produce innovative virtual learning experiences that meet the educational demand for 21st century skill-building.

Live virtual programs as curricular enhancements: a Penn Museum case study

In the spring of 2016, a Delaware high school teacher and technology administrator reached out to the Learning Programs Department at the Penn Museum to inquire about a series of curricular enhancements for two honors-level world history courses. Having implemented a new technology initiative, the high school team was interested in using the collections, educational outreach lessons, and digital content of the Penn



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Museum to augment their classroom learning. This request spurred the authors to collaboratively assemble a new series of synchronous virtual programs, drawing on four existing resources – archaeological objects, content experts, museum educators, and synchronous technology.

Outreach Programs Manager Allyson Mitchell was the first point of contact for the high school team, which was interested in engaging with the Penn Museum at multiple points throughout the semester. As it is located some distance from the institution, however, the school could not manage multiple on-site visits. To accommodate the request, the Penn Museum team packaged individual programs into a series that was financially and logistically viable for the school. Drawing from existing Penn Museum programs and resources, together they identified ways that the Museum's Mediterranean collection and archaeological content could contribute to their existing curriculum. Even at a distance, this series provided students with multiple points of connection and aligned with the school's newly adopted digital initiatives and emphasis on 21st century skill building.

Seeing an opportunity to combine virtual learning, educational programs, and archaeological content, Mitchell reached out to colleagues Hitomi Yoshida, International Classroom Manager, and Sarah Linn, then a Ph.D. candidate in Mediterranean archaeology at the University of Pennsylvania.² Ultimately, the team created a scaffolded educational series that brought the collections and expertise of the Penn Museum directly into the classroom using existing teaching methods, synchronous technologies, and trusted collaborative partners. The team combined preexisting educational content from the museum's International Classroom, IVL programs and an Artifact Loan Box to create a robust digital outreach package for the high school.

The Classical Artifact Loan Boxes were the first Penn Museum program that the school experienced. These portable artifact kits, curated by Mitchell, contain touchable objects from the Penn Museum teaching collections,³ as well as the *Reading Ancient Artifacts* worksheet and classroom lesson plan. Facilitated by the educator within a familiar classroom space, the Artifact Loan Box lesson teaches students how to apply their observation, critical thinking, and collaboration skills to their class curriculum. The boxes provide an introduction to archaeological practice and a physical touchpoint for the study of material culture. Over the course of the 30-day rental period for the Artifact Loan Box, the students returned to the objects for multiple IVL workshops conducted by museum staff.

To fill the needs of its expanding K-12 school audiences, the Learning Programs Department had recently created the virtual programs and studio, as well as the new positions held by Mitchell and Yoshida. The goals of the new one-hour interactive virtual workshops, designed around museum content, existing middle school field trip lessons, and synchronous technology, were intended to enhance existing lessons with active teaching strategies, object analysis, inquiry, and digital resources. Mitchell set up the dedicated virtual learning space, equipment, and facilitation methods to produce virtual workshops that align with the 21st century educational ambitions of the Museum.

Another component of the programmatic series was International Classroom (IC), a fifty-year-old program unique to the Penn Museum. IC was originally designed to facilitate direct interactions between international college students and local, K-12 students through one-hour, educational workshops about world cultures. As the new manager of this program, Yoshida expanded the role of University of Pennsylvania graduate students and scholars in archaeology and anthropology, enabling K-12 students to interact with real archaeologists. Yoshida works closely with graduate student experts as they move beyond the role of guest lecturer to become educational facilitators, equipped with contemporary pedagogical strategies⁴ that develop students' capacity to learn, create, and proactively implement their learning.⁵ With guidance from museum educators, graduate students craft interactive workshops that demonstrate how knowledge is generated in their own archaeological and anthropological inquiry.

Sarah Linn, a Mediterranean archaeologist, was one of the first archaeology graduate students to create an IC program with Yoshida. Linn's IC lesson, entitled Exploring the Classical World through Artifacts, is built on critical questions that ask how we know what we know, how might biases in ancient sources affect our understanding of the past, whose views are missing, and how can we fill in the blanks. The workshop begins by asking learners to consider the primary sources available to scholars studying the Greek and Roman worlds, emphasizing the reliance on textual sources. Learners are challenged to think critically about biases and omissions in written evidence by considering aspects of the ancient world that may be less "visible," such as non-elites, women and children, rural areas, and prehistoric periods. Linn explains that archaeology can help "fill in the gaps" by providing evidence of people, places, and time periods that are missing from written history. The program emphasizes the need to think critically about sources and consider multiple lines of evidence. To illuminate potential biases, learners compare types of archaeological evidence, including two objects from the museum's collections that were discovered at Kourion, Cyprus.⁶ When shown a marble face from a Roman sculpture and a fragment of a large ceramic vessel, they are asked which object they would choose if they were instructed to write a paper. Learners then explain their object choice, challenging them to consider their own biases toward material culture.

In the final part of the lesson, learners generate their own questions about ancient objects by responding to a set of prompts including, what do you want to know about this artifact, are these questions answerable, and if so, how would you go about answering these questions. Guided by these investigative questions, Linn models the activity with the entire group before learners break into smaller groups to replicate the inquiry process using objects from the Museum's teaching collection. These questions urge learners to think about, and discuss with peers, the types of questions archaeologists ask of material culture and how they attempt to answer them, emphasizing the formulation of research questions and creation of knowledge.⁷

Over the summer the Museum team began working with the high school educators to lay the groundwork for implementing the programmatic series in the fall. Mitchell helped the high school team to equip the classroom and become familiar with the technology and methods for IVL programs. Using the laptop webcam, external microphone, and classroom projection system, they met with Mitchell via video chat to discuss the schedule and implementation of the program series. Similarly, Mitchell and Yoshida worked with Linn to adapt her program for virtual visits. Linn became comfortable with the inhouse virtual learning space and practiced using a green screen.⁸ Mitchell also helped her become acquainted with virtual etiquette, asking her to speak up or pause when needed and to communicate what she was doing while on screen. While the program did not require substantive changes, the team made slight modifications, such as providing specific instructions for the classroom educator on when and how to distribute objects from the Artifact Loan Box and how to facilitate small group discussion around a single object.

The program series was implemented in the honors-level World History course in the fall semester. Students were first introduced to their unit on ancient Greek and Roman civilizations with the Classical Artifact Loan Box, containing replica coins, religious figurines, domestic tools, pottery, and the Reading Ancient Artifacts classroom lesson. After this initial classroom experience, students received the adapted virtual workshop led by Linn. As the critical approach to the primary source material in her IC workshop requires active discussion, this interaction had to be maintained as a virtual workshop. Using synchronous technologies, the structure and quality of the program remained the same, even at a distance, as students were able to respond to the critical questions posed by Linn in real time. Using synchronous technology also allowed for the physical activation of the accessioned collections. Linn was able to exhibit the two objects from Kourion, Cyprus – the marble face and the ceramic fragment – in the virtual learning space, showing them in three dimensions rather than static images. Using the document camera and green screen, Linn was able to magnify details of the objects that would otherwise be difficult or impossible to see (Figure 1).

Using teaching objects from the Artifact Loan Box, students had the opportunity to touch and analyze archaeological material with Linn's guidance. As with the on-site program, students worked in small groups with touchable artifacts to generate questions and responses based on their observations. With interactive conversation, Linn prompted



Activating Museum Collections

Figure 1. Venn diagram assists museum in activating collections for 21st century audiences.

students to consider potential methods for answering their questions and challenged them to expand on their initial responses while validating their suggestions by comparing them with real-world archaeological research methods. By pairing the touchable objects with the virtual visit, students were able to apply the methods learned in their classroom alongside an archaeologist, who explained the significance of these methods using examples from her personal experiences in the field.

Following their virtual visit with Linn, student groups participated in a second live virtual workshop, *Daily Life in Ancient Rome*, facilitated by Mitchell who prompted students to think, and act, like archaeologists. This workshop uses real artifacts and field notes from Penn Museum archaeological expeditions to engage students in interactive conversation as they complete a language worksheet and touch Artifact Loan Box objects in the classroom. As the liaison between the Penn Museum and the participating classroom educator throughout the series, Mitchell was familiar with the other programs and encouraged students to draw on their earlier learning experiences. The programs challenge students to think critically about their understanding of the past, model problem-solving techniques, and give students the skills to participate meaningfully in future museum experiences.

Following this digital outreach series, the school traveled to the Penn Museum for an on-site visit. At the Museum, the classes participated in IC workshops with prominent scholars who discussed their experience with archaeology, material culture, and museum curation. These content experts explained their role in curating exhibitions, which the student groups were able to tour before or after the workshop. The visit concluded with comprehensive gallery lessons led by the classroom teacher, who, like the students, felt a connection to Museum content and was now equipped with the methods of archaeological inquiry.

Developing a digital outreach package: addressing challenges with collaborative partners

The four-part program described above was created to address the high school's needs, and the collaborative effort fostered a closer connection between the school group and the institution, and between the students and Museum content. With a limited budget, the team established valuable cross-departmental relationships and designed a virtual museum outreach package promoting key 21st century skills, such as digital literacy, global competencies, and critical thinking.⁹ The following presents an analysis of the Penn Museum model. Each subsection explores potential challenges and offers strategies for forging interdepartmental collaborations, suggesting that synchronous virtual programming, when supported by a team, can reuse well-designed museum programs to engage new audiences.

Fear that IVL programs will decrease on-site visits to museums

Distance learning has a long history within formal and informal educational institutions and the transmission of knowledge reflects the technologies of the era.¹⁰ As people become accustomed to accessing digital content or video chat at the click or touch of a button, IVL programs meet students on a technological-middle ground. Working with quickly evolving technology presents its own set of potential threats. Some cultural institutions have

been slow to adopt digital trends for fear that this increased access to museum content might dissuade audiences from physically visiting brick and mortar institutions, thereby decreasing attendance and revenue.

In this model, IVL did not replace a physical visit, rather, the digital outreach package inspired an on-site trip to the Penn Museum. The school scheduled additional on-site programming and developed a gallery lesson that built on skills acquired during their IVL programs. By packaging existing programs, the outreach series and on-site visit increased revenue numbers, while the expense to develop the innovative program remained low. This collaboration did not require generating new programming, departmental procedures, or technological systems. Responsibilities such as teaching museum content, coordinating programming schedules, and facilitating technical operations were balanced among the collaborators, mitigating the pressure on any individual and providing a quality educational experience.

Virtual visitors require guided interpretation

The limited uptake of digital initiatives within museums has predominantly been aimed at digitizing collections through web-based, or asynchronous, experiences.¹¹ While digital collections provide much needed access, collection databases can be difficult to navigate without meaningful interpretation. Like on-site museum audiences, virtual visitors require intervention to synthesize digital content on institutional websites and social media platforms.¹² The controlled IVL setting allows for easy access to accessioned collections and provides a safe location for activating objects in meaningful ways, whether pointing out small details with the document camera or simply modeling appropriate object handling.

Artifact Loan Boxes that pair touchable objects with information on archaeological projects demonstrate how classroom research skills are applied to real-life contexts in the field. Illustrating the methods of archaeological inquiry using real and replica objects keep students engaged. The combination of live virtual visits and object analysis as implemented by the Penn Museum team, allows for guided facilitation that directs the learning process toward reasonable conclusions and encourages students to question and evaluate their own potential biases.¹³

Limited access to content experts

Institutional content experts often have many responsibilities associated with their positions and their interaction with museum audiences might be limited to formal, public lectures or to producing publications and online content. The Penn Museum's relationship with the university provides a breadth and depth of expertise in the form of faculty curators and researchers, as well as graduate students studying fields related to the Museum's collection. These students must learn to share their expertise with multiple audiences, including other specialists and the public, but many graduate programs offer limited teaching opportunities and few formal discussions of educational methods.

The chance to teach K-12 audiences provides invaluable opportunities for graduate students to work with museum educators to share their knowledge and research skills. Collaborating with museum educators develops pedagogical skills, such as inquiry-based 248 👄 A. MITCHELL ET AL.

teaching used to promote critical thinking for K-12 audiences. Graduate students can practice different teaching strategies using the same museum content, to fit audiences that range in age and background. As video interviews and online learning become more commonplace, participating in IVL programs also teaches students and educators how to virtually engage with audiences in meaningful ways.

Addressing 21st century teaching and learning in classroom and museum settings

Museum educators use contemporary teaching methodology to interpret museum content to meet the needs of K-12 audiences. An educational framework established by the Partnership of 21st Century Learning Skills¹⁴ calls for more open, self-directed, and experiential methods of teaching to address the dramatic shift from industrial-age to information-age skills and careers.¹⁵ Cultivating collaborative partnerships within the Penn Museum and with high school educators ensured that the educational experience enhanced the World History curriculum throughout the program series.

Institutional collaborations between graduate students and museum educators highlight museum content using teaching strategies that encourage learners to exercise critical thinking, collaboration, and problem-solving skills as addressed in the 21st century learning framework. This collaborative process also provides museum educators the opportunity to learn directly from content knowledge experts, building their content expertise and exemplifying the new model of learning partnerships.¹⁶

Design an IVL experience using available resources

As the digital world becomes increasingly sophisticated, cultural centers must consider how technology shapes institutional practices. According to a 2018 study "the dawning of the digital era [changed] fundamental aspects of education [thus changing] dominate paradigms for how organizations function [today]."¹⁷ Museums must confront the "essential role digital now plays in delivering [its] core mission and ambitions"¹⁸ and go beyond freely disseminated web-based content to meet the needs of their tech-savvy audiences and 21st century institutional goals.¹⁹ Collaborative efforts that draw on the four resources identified in the diagram (Figure 2) can build viable, virtual programs that meet the needs of the 21st century teacher, learner, and museum professional.²⁰ The diagram offers questions that can be applied to a range of cultural institutions interested in using existing museum lessons to design IVL programs with the 21st century framework.

What content can you activate with IVL programs?

Museums are unique educational resources that provide direct access to the raw material for knowledge construction.²¹ With interpretation, museum content – whether physical, digital, conceptual, or interactive – can introduce new ideas and provide deeper connections to previous knowledge. Activating museum content for IVL programs that fits the 21st century framework does not require the development of new educational programs, which can be both expensive and time-consuming. With strategic adaptations, existing



Figure 2. Linn facilitating a live virtual visit as she presents Penn Museum collection objects to the student group using the digital background projected by the green screen.

museum offerings can continue to serve primary audiences and extend the reach of the institution through IVL programs.

Who are your content experts?

Experts within or adjacent to the institution have deep knowledge of, and unique connections to, museum collections and research. As it relates to museum content, they provide access to the epistemological understanding of the nature, sources, and construction of knowledge, which forms the foundation of critical thinking.²² Content experts can serve as models for authentic applications of 21st century skills, demonstrating how knowledge is produced and interpreted.²³ Expanding the perception of the content expert to include those adjacent to the museum, such as advanced students in related fields, increases the breadth of expertise and the number of available program providers.

How can your museum educators assist content experts with interpretation?

Educators must have the pedagogical capacity to "form partnerships with students in mastering the process of learning," shifting the role of teacher from disseminator of knowledge to facilitator of learning.²⁴ Museum educators interpret collections using instructional approaches and tools that engage students in active discourse about how knowledge is constructed. With the growing demand for innovative, 21st century learning opportunities, content experts can draw upon the pedagogical expertise of museum educators to create effective educational experiences. These collaborative partnerships can build programs that guide diverse audiences to engage with museum content and practice critical thinking and problem-solving.²⁵ 250 👄 A. MITCHELL ET AL.

What technology can facilitate your interactive virtual learning programs?

Digital access allows for independent learning and global connections that extend beyond a traditional education environment.²⁶ In a world ready to "go live," museums do not require expensive technology or cumbersome hardware to engage groups in synchronous virtual programs. Instead, institutions should define the digital skill-set needed to activate museum content using the accepted educational framework and available technology. Cultural institutions can support synchronous virtual programming, while limiting expenditure, by identifying a dedicated digital museum educator responsible for using technology to achieve 21st century learning outcomes and meet institutional goals.²⁷

Museums should embrace synchronous technology as a tool for meeting learning outcomes

Live virtual museum visits can expand institutional audiences, enhance existing programming, and provide a holistic educational experience to the 21st century student, teacher, and museum professional.²⁸ For those learning from a distance, a series of synchronous virtual programs can foster deeper connection with museum content and build a relationship between the group and the institution through multiple points of connection.²⁹ Collaborative efforts that acknowledge the unique skill sets of museum professionals, diversify the roles of the expert and the educator, and creatively apply existing resources, can produce sustainable and meaningful programs that increase departmental returns. Immersive virtual learning that activates museum content and connects audiences with experts can spark the interest of younger generations and motivate participation in future museum visits, both on-site and virtual.

Notes

- The Penn Museum is one of the largest university museums in the United States. The Museum was built to house material recovered in early archaeological and anthropological expeditions and holds around one million artifacts. Along with the physical collections, the Penn Museum maintains the associated project records, including notebooks, site drawings, and photographs, which provide the context necessary for interpreting the collections.
- 2. International Classroom educators are paid a small honorarium for each one-hour workshop they facilitate.
- 3. In addition to its accessioned collection, the Penn Museum has maintained a teaching collection since the mid-1930s. This collection, managed by the Learning Programs Department, is comprised of more than 4500 touchable artifacts representing ancient and contemporary cultures from around the globe. The Learning Programs Department interprets the museum content to develop K-12 educational experiences that "illuminate the history of humanity."
- 4. National Education Association. Partnerships of 21st Century Learning. *Preparing 21st Century Student for a Global Society*.
- 5. Fullan, Langworthy, and Barber, A Rich Seam.
- 6. Kourion was excavated by the Penn Museum from the 1930s to the 1950s and many of the objects, as well as the archival records, are now held within the Museum's collection.
- 7. Fullan, Langworthy, and Barber, A Rich Seam, 21-9.
- 8. A fabric or painted backdrop that an individual or object stand in front of for live broadcasts and films. The brightly colored green screen background and a process called chroma keying, allows a digital content be displayed behind the person or object on screen. Video conferencing room units have built in chroma key technology that allows presentation slides, video

content, and a document camera to project behind the individual facilitating an IVL experience.

- 9. National Education Association, Preparing 21st Century Student for a Global Society, 8-29.
- 10. Lindsay, The Global Educator.
- 11. Parry et al., One by One: Building Digitally Confident Museums.
- 12. King, Brad, and Lord, Manual of Museum Learning.
- Schultz. "Object-based Learning or Learning from Objects in the Anthropology Museum," 282–304.
- 14. P21 Network, "Battle for Kids."
- 15. Parry et al., One by One: Building Digitally Confident Museums.
- 16. Felton and Kuhn "How Do I Know?' The Epistemological Roots of Critical Thinking," 101–10.
- 17. Parry, Barnes, and Kispeter, Mapping the Museum Digital Skills Ecosystem, 34.
- 18. Ibid., 34.
- 19. King and Lord, Manual of Museum Learning, 86-7.
- 20. The resources below are discussed separately to explain their primary roles, but they are often not distinct entities and regularly overlap when creating opportunities for innovative learning experiences.
- 21. Felton and Kuhn, "'How Do I Know?' The Epistemological Roots of Critical Thinking," 101-10.
- 22. Ibid., 101-10.
- 23. National Education Association, Preparing 21st Century Student for a Global Society, 8–29.
- 24. Fullan, Langworthy, and Barber, A Rich Seam, 21-9
- 25. Felton and Kuhn, "'How Do I Know?' The Epistemological Roots of Critical Thinking," 101–10.
- 26. Fullan, Langworthy, and Barber, A Rich Seam, 32-7
- 27. Parry, Barnes, and Kispeter, Mapping the Museum Digital Skills Ecosystem, 9-10.
- 28. King and Lord, Manual of Museum Learning, 86-8.
- 29. Fullan, Langworthy, and Barber, A Rich Seam, 76-9.

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Disclosure statement

No potential conflict of interest was reported by the authors.

About the authors

Allyson Mitchell is the Outreach Programs Manager at the University of Pennsylvania Museum of Archaeology and Anthropology (Penn Museum). She develops and manages virtual programs which received a Pinnacle Award from the Center of Interactive Learning and Collaborations (CILC) for three consecutive years. Prior to joining the Penn Museum, Mitchell served as the Curator of Education at the Delaware History Museum, where she created a new Distance Learning studio. She has a B.A. in Art History and Italian, and a M.A. in Museum Education at the University of the Arts.

Sarah Linn earned a Ph.D. in Mediterranean archaeology from the University of Pennsylvania in 2018. Her research focuses on the Bronze Age Aegean and she has excavated at sites on Crete and

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mainland Greece. As the Research Liaison at the Penn Museum, Sarah works with students, staff, and faculty to make the museum's collections and research more accessible to all audiences, including K-12 schools.

Hitomi Yoshida is the Diversity Programs Manager at the Penn Museum. At the Learning Programs Department, she operates the International Classroom, a global learning program which mobilizes International educators and Archaeology experts for K-12 education. By building partnerships with diverse professionals and organizations, she offers educational resources in the area of cultural heritage, global citizenship and intercultural learning. She received a B.A. in English from Ohio State University and a M.S. Ed. in Intercultural Communication from the University of Pennsylvania.

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