

Museum Digital Engagement: Before, During, and Beyond the COVID-19 Pandemic

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About this resource

In 2021, the [Association of Science and Technology Centers](#) (ASTC) launched a project to learn about our members' experiences, challenges, and opportunities when it comes to digital engagement. We have sought to answer the question: What do science centers and museums need to continue to provide creative, effective, and equitable digital programs for diverse audiences?

We held two virtual events for science center and museum staff in 2021 and 2022, which launch generative conversations. We hope to continue these conversations in the ASTC Community of Practice on Digital Engagement and through subsequent projects that will address the future of museum digital engagement. You can learn more and access additional resources produced on our [project webpage](#).



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Introduction

The COVID-19 pandemic prompted a dramatic increase in the number and type of digital engagement opportunities offered by museums, science centers, and other informal learning institutions. While some efforts to expand digital engagement existed pre-pandemic, the sudden pivot away from in-person experiences, especially early in the pandemic, led to a dramatic increase in the number and breadth of digital experiences across our field. As museums are now trying to determine whether and how to maintain these digital programs, this literature review helps pull together some of the most relevant knowledge about research, opportunities, and challenges that museums face in digital engagement.

Museums' exploration of digital engagement was limited pre-pandemic

Prior to the pandemic, terms such as *digital engagement* and *virtual learning* often appeared in museum-based literature in reference to the technology used within a museum's walls. Distance learning opportunities were being explored and discussed as possibilities (Bontempi 2012). The museum field as a whole was experimenting with new technologies, virtual accessibility, and ways to compete in a digital world (Digital Transformation 2016).

During this time, museums were seeking to appeal to younger generations as researchers found that Millennials often made up cultural institutions' largest visitor population (Dilenschneider 2016). As a result, the field saw an increase in digital interactive elements, audio tours, and information made accessible via smartphone (Saha 2019). Technology was also being used to advance accessibility and inclusion, with seeing-through-touch methods, beacon technology, and expressive audio descriptions (Long 2018). Digital interactives were found to improve conceptual understanding, particularly about science topics (Yoon 2012). As museums digitized their collections and made images available under Open Access policies, visitor interest increased (Song 2017), and, as museums began incorporating technology into their spaces, researchers called for digital improvements that were purposeful, not flashy (Butler 2017).

In addition, museums were offering *museum distance education*. In the mid to late 1990s, museums began offering distance learning opportunities and using streaming media to provide recorded content to visitors (Bontempi 2012). Distance learning was largely focused on supporting K-12 education through partnerships with schools and youth organizations, while digital interactives enhanced experiences within the physical museum. The presence of distance education and digital learning varied across institutions based on the expertise and the institution's funding. Many museum teams still believed that they best engaged with visitors physically at the institution, but they were also experiencing an increase in traffic to their institutions' websites and social media platforms (Digital Transformation 2016).

In the 2010s, museums were beginning to recognize the value of personalized and immersive experiences within the digital sphere. As a result, some museums— created experiences on platforms like Second Life—an online multimedia platform that allows people to create an

avatar in an online world (Wikipedia 2022)—that allowed visitors to “participate in gatherings, listen to lectures, and to interact with the collections” (Bontempi 2012). Museums were using the internet and technology to increase their reach.

The most common challenges for pre-pandemic digital engagement included funding sources, need for evaluation, training for staff in the use of digital technologies, and having defining purposes for projects (Lang 2016). Additional challenges included lack of access to technology (Bowen 2017), technology malfunctions (Din 2015), and the cost of maintaining equipment (Hardee 2015). Museums were also looking to stay relevant and compete for visitors’ limited recreational time (Culture Tracker 2017). Many of these challenges have persisted through the height of the pandemic and are now receiving increased attention as more museums join the digital programming landscape.

The pre-pandemic literature on digital engagement and distance learning is still very relevant to the museum field. While the pandemic served as an impetus for dramatically increasing the digital engagement opportunities offered, many of these ideas existed pre-pandemic and even faced some of the same challenges that museums are facing today.

Museums focused on digital engagement during the pandemic

In December 2019, as the COVID-19 pandemic began and public spaces started to close for an unknown amount of time, museums, science centers, and other informal learning institutions were compelled to imagine new ways to interact with their visitors. Many of these institutions relied heavily on—welcoming visitors into their physical spaces (Ennes 2021). But, as a result of the pandemic, museums could no longer use their physical gallery spaces and digital engagement became the only option as museums closed their doors (Ennes 2021). As their digital engagement efforts grew, museums encountered challenges and opportunities in the areas of accessibility, engaging visitors online, collaboration, funding, staff burden, and effective evaluation.

Accessibility

As museums increased their digital learning offerings, challenges and successes around accessibility came to the forefront. Museum teams found that digital engagement could increase their reach beyond their immediate communities as they used virtual reality and digital experiences to welcome distant visitors into their spaces (Mamur 2020). Additionally, accessibility increased as transcripts, subtitles, and translations could be added to digital programs (especially with recorded content) more easily than in-person programs—though not all museums put in the effort to include these accessibility features (Peruzzi 2020).

However, shifting to digital programs also highlighted disparities in access to technology and digital content. For example, not everyone has equitable access to internet services (Reddick 2020), museums in developing areas around the world have not been able to provide online content (Unesco 2020), and the elderly tend to avoid online learning (Park 2021). Additionally, technology that is not easy to use is seen as a barrier and these expectations have only

increased as a result of the pandemic (Dilenschneider 2021). Some museums struggled to purchase technology when supply chains were disrupted, and manufacturing processes slowed. Museum practitioners have also stated that new technology adds another layer of stress to programming as they never know when or how it might malfunction (Ennes 2021b).

For some institutions, the move to digital offered a chance to create more accessible, inclusive, and user-friendly programming. For example, the Olana State Historic Site had to quickly adapt its in-person, creative aging program for audiences ages 55 and up into the institution's first online course. They found that digital programming was a more accessible and cost-effective option because homebound audiences could participate, travel time and inclement weather were no longer factors, and the lack of physical supplies reduced costs (Sachar 2020). Additionally, organizations such as The Museum Learning Hub are creating and offering free training resources for small museums, including modules on digital accessibility training (Museum Learning Hub 2022). The American Association for State and Local History is championing the free Clio app to create virtual tours of their institutions (Wuertenberg 2020).

Equity and anti-racism

Many museums are working to address equity and anti-racist issues (Wallace 2021) and—in many cases—digital programming is being used to support these efforts. For example, the Exploratorium worked with 500 Queer Scientists to hold a digital event that discussed the development of an exhibit that will tell first-person stories of LGBTQ+ women and gender minorities working in STEM, while centering people of color. (Exploratorium 2022). The Stonewall National Museum and Archives launched *In Plain Sight*—a virtual exhibit of “a digital timeline that highlights pivotal LGBT figures and achievements” (Arnold 2021). Additionally, museums are digitally sharing exhibits on black history, racism, and protest (Nalewicki 2020).

Engaging visitors online

Competing for visitor attention online is different than competing for visitorship in-person, as digital content is now virtually endless (Ciecko 2020), while people's recreational time is limited. During the pandemic, children and students spent more time on computers and other devices than before the pandemic, so in leisure time, parents pushed for screen-free pursuits (Osmanski 2021). Museums have an advantage in that they are seen as credible sources of information and this reputation was even more apparent during the pandemic (Dilenschneider 2021). The most searched terms of 2020 that started with the word “virtual” were “virtual field trip” followed by “virtual museum tours” which shows people's strong interest in connecting with cultural institutions during the first year of the pandemic when normal activities were disrupted (Davis 2020). The increased digital presence of museums has served to increase the public perception of their trustworthiness (Hekkers 2021).

There are many different ways that museums have been engaging their audiences in the digital space, and—because visitors are not a homogenous population—different opportunities appeal to different people. Some visitors want personalized, engaging, and shareable experiences; some prefer storytelling formats, such as curator talks or programs

presented as a series of episodes that are short, answer a question, and have an enthusiastic host; while other visitors want longer, more informationally dense material (Wilkening 2021, New Technology 2022). Museums and science centers rose to the challenge by creating many different types of programming.

Some museums moved their in-person experiences online. The National Children’s Museum created an online quiz so that children could discover their inner “Climate Action Hero,” just like they would in person (National Children’s 2022). The Tech Interactive—a science and technology center in San Jose, California—started a TikTok account that has reached millions of users with short, engaging, easily digestible scientific information and facts (The Tech Interactive 2022). Other museums created podcasts, like the Museum of Science, Boston, with their “Pulsar” podcast that features interviews with museum educators and notable scientists, researchers, and engineers. (Pulsar 2022). Some institutions created virtual visits and 3D tours of their museum spaces, like the New York Botanical Garden that allows visitors to take a virtual walk through their gardens (Feinstein 2020) or the North Carolina Museum of Natural Science’s 3D virtual tours (Virtual and Self-Guided Tours 2022). Still other institutions found engaging ways to use their empty space, like the Shedd Aquarium, which let their animals wander the galleries (Maragos 2020), and the many zoos and aquariums that set up live cameras on their animals (Ciecko 2020). Many museums took advantage of the pandemic to create or expand on their virtual field trips for schools and students who cannot otherwise come in person. The National Air and Space Museum adapted its planetarium show so that it could be experienced virtually (Virtual Planetarium Shows 2021). Some programs are presented live with limited visitor interaction, such as Junior Science Cafes at the Museum of Science and Industry Chicago (Field Trips 2022). Some programs, like one from the Monterey Aquarium, allow visitors to interact with museum staff and other visitors through interactive platforms such as Twitch (MontereyAq 2022). Other institutions pre-record their content so that visitors can experience it on-demand. For example, the California Science Center offers both “on-demand” virtual field trips that have been pre-recorded as well as live virtual field trip experiences that offer interaction between students and staff (Virtual Field Trips 2022).

Collaboration

During the pandemic, museum teams have explored new opportunities for collaboration within their institutions, across institutions, and with their communities. Departments within institutions began collaborating in new ways they never had before, with one common example being marketing departments stepping in to help education departments run digital programs (Ennes 2021b). The responsibility for these digital projects was no longer confined to specific departments but was instead being led by the people with the necessary technological skills (Ennes 2021c). Additionally, there has been more cooperation among museums as they worked together to find common solutions (UNESCO 2021). For example, in Philadelphia, Pennsylvania, the city’s six art museums formed a working group to brainstorm around financially surviving the pandemic (Salisbury 2020). Institutions also found new ways to collaborate with schools, which were encouraged to partner with organizations like museums that were already offering online materials (Butcher 2020). The American Alliance of Museums (AAM) created a repository of museum distance learning resources for teachers

and parents at home (Distance Learning Database 2020). There has also been an expansion of the ways museums are working with their communities. For example, the Museum of Life and Science created a program called “Real Science: Field Trip Fridays,” in which their staff explores and shares science happening in their region (Real Science 2021).

Funding

Funding has been a major source of concern throughout the pandemic. Because of closures and lost visitor revenue, it was estimated that ASTC-member science museums lost more than \$600 million in revenue in the first six months of the pandemic (ASTC 2021). In the United Nations Educational, Scientific and Cultural Organization (UNESCO) 2021 report, it was revealed that across all types of museums around the world, revenue had dropped 80% compared to 2019, 43% of museums faced closures in the first quarter of 2021, and 50% of countries involved in the study reported that public subsidies for national institutions had decreased (UNESCO 2021). Museums had to decide if they were going to charge visitors for digital programs and struggled to find a balance between serving the public and making ends meet (ASTC Pre-Conference 2021).

Museums were forced to find ways to generate new revenue streams. Some museums were able to hold virtual fundraisers or virtual galas (Bousquette 2020), such as the Field Museum, which switched to a virtual gala model in October 2020 (Field Museum 2020), and George Washington’s Mount Vernon, which held a celebration virtually in 2021 (George Washington National Birthday 2021). In a survey launched by Cuseum in January 2021, 25% of participants reported their institution had held a virtual gala (Cuseum 2021). Other museums began limiting access to certain digital content to only museum members. The Cuseum report shows that under a quarter of participating museums had adopted this strategy at the beginning of 2021 (Cuseum 2021). James Madison’s Montpelier created classes that were free for members, but non-members paid a fee (Faber 2020). At the beginning of the pandemic, The Barnes Foundation also pivoted quickly and offered paid online classes for adults (Museum Booster 2021).

Staff capacity

The burdens carried by museum staff during the pandemic were discussed at ASTC’s Pre-Conference Digital Engagement Session, with participants describing that their museums had to downsize their staff and that remaining employees were overworked and facing high levels of stress. Almost half of the 659 museums surveyed by AAM for their *National Survey of COVID-19 Impact on United States Museums* reported having to furlough or lay off employees (AAM 2020). Staff had to take on many roles—including ones they were unfamiliar with—to fill in gaps at their institutions. Time for training staff was limited (ASTC Pre-Conference 2021) and difficulties arose from the large variety of devices, platforms, software options, and operating systems available. Museum educators had to shift to using pedagogies where senses like touch could not be used and many of them did not feel confident in publishing high-quality content online (Ennes 2021a).

Despite all of this, the museum sector as a whole reacted very rapidly in developing its online presence (UNESCO 2020). Staff learned to be flexible and produce content quickly and creatively (Washington 2021). Additionally, practitioners across the museum field worked to help each other, as evidenced by the increase of webinars via platforms like Zoom. Many professional organizations produced content for the field. For example, MuseumNext’s Digital Summit in 2021 focused on examples of how museums pivoted to using online tools, where museum educators showed their colleagues how to use digital platforms and methods like Google Classrooms, talked through effective technology, how to use it, and how audiences responded (MuseumNext 2021). AAM also has a series of articles, studies, and platform suggestions for its members (Distance Learning Database 2020). ASTC convened regular conversations of its members—including through the Re-Think, Re-Frame, Re-Open series of virtual events—launched a weekly Operations and Attendance Survey and lifted up examples of digital engagement across the science center field.

Effective evaluation

During the pandemic, museums and evaluation teams worked to adapt their evaluation efforts to document the pandemic’s significant impacts on the museum field (Wallace 2021). For example, the AAM conducted a benchmarking survey titled *National Survey of COVID-19 Impact on United States Museums*, which documented museums’ planned re-opening dates, layoffs and furloughs, financial impact of the pandemic, and the services museums provided during COVID closures (AAM 2020). Additionally, the research firms LaPlaca Cohen, Slover Linett, and Yancey Consulting collaborated on a Culture Track project titled *Culture + Community in a Time of Transformation*, which “is a national research initiative aimed at bridging the cultural sector with the experiences and needs to its communities and audiences during the pandemic and beyond” (LaPlaca Cohen 2021).

Professional evaluation associations—such as the Visitor Studies Association (VSA) and the American Evaluation Association (AEA)—remained active during the museum closures. The VSA offered instructive evaluation webinars and evaluator support groups to help ensure evaluation could continue while museum doors were closed to the public (VSA 2022). The AEA offered e-study courses and coffee breaks, 20-minute recorded presentations, to share evaluation techniques and methodologies (AEA 2022). AAM promoted content on analytics and evaluating museum digital experiences (Museum Learning Hub 2021).

Program evaluations also continued through the pandemic. For example, the Discovery Center for Evaluation, Research, and Professional Learning conducted an evaluation of digital modules created as part of the *STEM in the PlayScape* project (Woodruff 2020). Additionally, the Concord Evaluation Group conducted an evaluation of a free app that syncs with a television program, called *Splash! Ask-Me: Ocean Adventures* (Paulsen 2021).

In some ways, the increase in digital engagement has made evaluation easier as the programming has allowed for more data collection for use in evaluative studies and assessing audience trends (Ennes 2021a). Digital platforms automatically track user information and use analytics; however, this data is not verifiable and may not be of high reliability (Chai 2022).

The future of museum digital engagement

Museums and cultural institutions are beginning to imagine their relationships with digital engagement in the post-pandemic era. A recent Cuseum webinar (Ciecko, Law, Brady & Robson 2022) identified several themes for the future of digital engagement including hybrid experiences, flexible programming, focus on visitor needs, revenue from digital sources, and understanding potential technological innovations.

Hybrid experiences

While during the height of the pandemic many institutions had to shift to online-only experiences, as many people return to normal activities, institutions are learning how to manage a blend of in-person and digital experiences. This hybrid model can be twice as challenging to execute as wholly in-person or online models. A truly effective hybrid experience feels seamless for those online and allows them to interact and engage with staff and content. The Barnes Foundation has created successful hybrid programs that give online learners access to high-resolution images of artwork that in-person visitors are viewing (Ciecko, Law, Brady & Robson 2022). They have also invested in technology that allows for more natural interaction between in-person and online visitors.

Some programs lend themselves to hybrid experiences more easily than others. The digital experience often needs a completely different approach than in-person offerings because some program types suffer when the online delivery mimics the in-person delivery. Tricia Robson from the Metropolitan Museum of Art shared that lectures with high-profile names and live performances have proven to be the museum's most successful models for hybrid programming (Ciecko, Law, Brady & Robson 2022). As museums experiment with hybrid models, they will benefit from taking into consideration how they can best deliver programming for their in-person audiences versus their online audiences.

As a result of the pandemic, many institutions have invested in contactless solutions to deliver content to in-person visitors. While these experiences are similar to the hybrid experiences described above, they are distinct in that they refer to having a digital experience exclusively within a physical space. A new term coined "phygital" (phy-gital blends the *physical* experience with the *digital* experience) is being used to describe this concept. Common examples of phygital experiences—many of which existed well before the pandemic—are digital tours or digital programming offered within a gallery or exhibit space. It is likely that the use of these phygital experiences will increase going forward. Necessity has often bred innovation for this type of offering, as was the case with the advent of virtual volunteers at the National Air and Space Museum. Many of the museum's volunteers were unable to return to the museum during the pandemic even after it had reopened. As a result, the museum team set up a webcam and screen in the museum so that visitors in-person at the museum could interact live with a volunteer off-site (Kosarin 2021).

Agile programming

Another feature of future digital programming will be the ability to be as flexible as possible. The teams at museums and other cultural institutions know that guidelines for in-person experiences, like social distancing requirements and maximum capacity limits, can change at a moment's notice. Additionally, visitor comfort with being in a physical space can likewise change overnight. The Metropolitan Museum of Art has created task forces for dealing with unexpected external factors and has a system in place for dealing with various scenarios (Ciecko, Law, Brady & Robson 2022). This has enabled them to be more agile in dealing with the ups and downs of the continued COVID-19 pandemic. Integrating digital programming into a museum's strategic thinking at all levels will be critical for managing future unexpected scenarios.

Audience research

The ability to reach audiences far beyond the physical walls of their institution's physical space has revolutionized the way many museum teams think about who and where their audiences actually are. As Steve Brady from the Barnes Foundation mentioned in their webinar *Museums in the Year Ahead* there are more people that you can reach online than may ever visit your city. This is a huge untapped potential, but it is also a big undertaking for an institution to shift their thinking about their audience's needs and interests. In 2021, the Museum of Contemporary Art Denver saw their digital audience grow from 6% to 40% in 2021 (Ciecko, Law, Brady & Robson 2022). In the future, institutions are likely to see a continued increase in opportunities to reach a worldwide audience through digital programming.

This increased access to geographically distant audiences through digital platforms means that institutions will need to deepen their understanding of this broader group through informal and formal audience research. Understanding the needs of different audiences and how they best learn through digital programs will be critical moving forward. At the beginning of the pandemic, the Barnes Foundation had a solid understanding of their audience's needs and interests. They measured and reacted to these needs quickly, which drove up participation in online programming and led to increased revenue overall. Many digital platforms have built-in data and data-analysis features such as Google Analytics, YouTube, digital education platforms, and QR codes. Institutions will need to define their own metrics as a way to understand what success and/or growth looks like for their organization. At the Museum of Contemporary Art Denver, for example, they have defined audience engagement metrics to determine the success of their YouTube Videos (Ciecko, Law, Brady & Robson 2022).

Increased Revenue from Digital Sources

Institutions will need to incorporate financial models for digital programming into their budgets and organizational planning moving forward. Most institutions do not have access to highly trained digital experts: the museum field is depleted of this important talent base because corporations can typically afford to pay higher rates (Center for the Future of Museums 2021). The internet model of creating free content to garner attention and support

is not feasible for most museums long term, but they often work to fulfill their missions by creating educational resources that are available to those who could not otherwise afford access to paid experiences. Striking this balance will be challenging, but the example at the Barnes Foundation shows that it is possible to create exclusive paid content while still providing access through scholarships. During 2021, the foundation brought in more money through digital programs than through in-person experiences (Brady & Stewart 2021). The Cuseum report on revenue generation for digital programming shows that institutions are not confident that they can make money with virtual programming. Only 13% of respondents reported projections above \$50,000 from their digital programs for the year and less than a quarter offered virtual membership options (Cuseum 2021). Digital programs have a huge untapped potential for revenue in the future and museums will need support figuring out how to best leverage this.

Technological Innovations

Museums and other cultural institutions are now paying closer attention to technological innovations such as the Metaverse (Ravenscraft 2021), virtual reality experiences, and non-fungible tokens (NFTs) and how they will shift digital museum experiences moving forward. The industry is seeing a trend toward gamification within physical museum spaces, digital games set inside replicas of museums, or even entire museum exhibits explored through a game experience, such as at the Computer History Museum's Minecraft virtual exhibit that explores ideas around technology's relationship with humanity as visitors play Minecraft (Du 2021; CHM Editorial 2021). The exhibit "New Fiction" by KAWS was released on the game Fortnite and, as a result, reached millions of visitors who otherwise would not have had access to experience the exhibit in-person (Ghassemitari 2022). In the early part of the pandemic, the Metropolitan Museum of Art added their collections to the game Animal Crossing (Richardson 2021).

Virtual reality experiences will continue to evolve and barriers to access will decrease as technology becomes more wearable in the future. Virtual reality goggles will be replaced with virtual reality glasses and could more easily be integrated into museum spaces (Stein 2022). Opportunities to create full-immersion virtual reality experiences in the museum, as well as off-site, will continue to expand as these technological innovations continue to become more ubiquitous.

In all, hybrid or blended physical and digital experiences are here to stay and will continue to be prevalent in the future. Some programs will be best suited for online-only while others will be best for in-person only, but museums will need to be strategic about how and where they host their events. Museums will also need to continue to be flexible in the years ahead, adapting to the ever-changing situation related to the pandemic as well as new technologies and innovations. Audience research and user analytics can help to support a museum's strategic plan and decision making and help leaders handle challenging situations that may arise. Finally, new technologies will allow for increased innovation and creativity blending the physical and the digital in the museum field.

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