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Digital Engagement and Wellbeing: The Impact of Museum Digital Resources on User Wellbeing During COVID-19

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ABSTRACT

The global “COVID-19” pandemic resulted in national lockdowns and the closure of museums to visitors. The pandemic had considerable negative impact on individual, community, and society wellbeing and changed museum practice, specifically through increased online presence. This pilot research sought to start to understand the impact online museum provisions had on individual wellbeing during the pandemic. It applied and adapted public health accredited measures to begin to provide empirical quantifiable evidence of the impact and significance of online museum resources on user wellbeing during the pandemic and to consider the value of digital technology within sustainable heritage practices. It sought to consider if the integration of wellbeing objectives into museum digital interpretative strategies could provide a mechanism to support sustainable museum practice and wider social, economic, cultural, and environmental sustainability agendas. This pilot research indicated that digital museum resources had specific and significant impact on user wellbeing and suggested that further research is needed to understand the impact of digital technology within museums and its impact and role in both improving wellbeing and reducing wellbeing inequality.

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Introduction

From December 2019 the coronavirus (COVID-19) rapidly spread across the globe, forcing national governments to impose extraordinary measures, lockdowns, and restrictions in an attempt to reduce infections and fatalities. The COVID-19 pandemic continues to have a profound global impact, one that has been felt across all industries, including the heritage sector. The recent report *Rebuilding Europe: The Cultural and Creative Economy Before and After the COVID-19 Crisis* indicated that the COVID-19 pandemic negatively impacted the cultural and creative sector more intensely than any other industry except aviation (EY Teams 2021). Research by ICOM and UNESCO highlighted that COVID-19’s impact on the sector was not a solely European phenomenon, as museums “all over the world” and “on all continents” have been affected (ICOM 2020; UNESCO

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2020). COVID-19 has had a complex and diverse impact on the global heritage sector, from canceled exhibitions to plummeting visitor numbers, and dramatically decreased revenues, donations, and memberships. One significant and well-researched effect of COVID-19 on the heritage sector was the rapid increased focus on and creation of digital resources in many parts of the world (Agostino, Arnaboldi, and Lampis 2020; Burke, Jørgensen, and Jørgensen 2020; Giannini and Bowen 2022; King et al. 2021; Magliacani and Sorrentino 2021; Morse et al. 2022; Noehrer et al. 2021; Pourmoradian, Farrokhi, and Hosseini 2021; Resta et al. 2021; Samaroudi, Echavarria, and Perry 2020).

The utilization of digital technology to share, promote or engage with museums was not a new concept, from the late 1990s digital has generated new ways for the public to engage with museums (King, Stark, and Cooke 2016). The growing use of digital technology within museum settings has resulted in debates about whether digital engagement can offer the same experience and benefits as physical heritage engagement (Parry 2013). Digital technology has been criticized, by some, as facilitating superficial entertainment, and inauthentic experiences and perceptions of heritage compared to physical engagement (Parry 2013). Specifically, it has been argued that digital's lack of physical engagement in heritage and social settings, in which museums and heritage sites are situated, fails to create longer term memories, or develop deep learning and social values, such as wellbeing, that the physical experience of visiting a museum can support (Poria, Butler, and Airey 2003; Wang 1999). Despite some potential reservations regarding the comparative value and impact of digital engagement, "building on [digital] investments made before the pandemic" were a significant part of museum's activities during COVID-19 (UNESCO 2020). This resulted in a "rapid reassessment of the rationale for and purpose of digital engagement, placing it not as an enhancement to usual delivery or form of entertainment, but at the core of museum delivery" (Noehrer et al. 2021, 2). For the first time, during the COVID-19 pandemic digital engagement replaced physical engagement of the public with museums (Hoffman 2020, 210). A survey of 650 museums in 41 countries conducted by the Network of European Museum Organisations (NEMO) demonstrated that over 60% of museums increased their online presence due to social distancing, lockdowns, and forced closures (Network of European Museum Organisations 2020). These trends are mirrored in global research conducted by UNESCO and by ICOM; ICOM'S survey of almost 1600 museums/museum professionals from 107 countries across 5 continents revealed a significant increase and introduction of new digital services during COVID-19 (ICOM 2020; UNESCO 2020).

Museums utilized a variety of digital technology during this period, including virtual tours, which were promoted in the media globally as an alternative to physical visits and engagement (Begley Bloom 2020; Braun 2020; Coffey 2020; Daily Sabah 2020; Dawson 2020; Jones 2020a, 2020b; Libot 2020; Lovell 2020; Marshall 2020; McKeever 2020; The Greek Herald 2020; The Indian Express 2020; Wilson 2020). Digital museum resources included, but were not limited to, using digital technology to provide the public with:

- **online lectures, talks, and Q&A's** such as *Why Models Work: The First Peoples Edition* hosted online by Melbourne Museum (Australia) and *The Future of Art Exhibitions in Public Spaces* by Dr. Bhau Daji Lad Museum (India).
- **online 360° tours**, for example, the *Blitzed* exhibition at Nuneaton Museum & Art Gallery (UK), *The Journey Back Home: An Exhibition of Chinese Artifacts Repatriated*

from Italy at the National Museum of China (China) and live virtual tours for school classes at the Guggenheim (USA)

- **interactive/live discussions with museum professionals**, such as Curator Chats hosted on Instagram live by Amy Galpin, chief curator of the Patricia and Phillip Frost Art Museum (USA), the National Air and Space Museums' (USA) Live Chat YouTube series and the University Museum of Contemporary Art's (Mexico) Instagram live Conversation series
- **online exhibitions** such as *Lisburn and the Second World War* by the Irish Linen Centre, *Status. Power. Movement* at Berlin Cultural Forum (Germany), the *Spring Festival* at the Palace Museum (China), and *Young Rembrandt* at the Ashmolean Museum (UK)
- **videos** for example the Cocktails with a Curator series at the Frick (USA) and the launch of a YouTube channel for Musée Paul Valéry (France)
- **collection databases**, such as the British Museum's revamped online collection (UK), unveiled early due to the COVID-19 pandemic
- **educational resources, classes, and activities** for example The Hunterian's *Learning from Objects* resources (UK), the Natural History Museum of Utah's "On-Demand Classes" (USA), and the Royal British Columbia Museum's dinosaur drawing classes (Canada)
- **increased social media presence and interactions**, including series such as the Getty Museum Challenge (USA), #MuseumUnlocked conceived by Dan Hicks, Pitt Rivers Museum (UK), and #CuratorBattle, run by York Museums Trust (UK)

Research by NEMO indicated that during this period numerous European museums experienced an upsurge of up to 40% in online visits: specifically 41% of museums noted that online visits had increased by up to 20% per week, 38% increased by 50% per week, 8% increased up to 100% and 13% had increased by 500% (Network of European Museum Organisations 2020). Correspondingly, the COVID-19 Cultural Participation Monitor survey (UK) and the *New Zealanders' Cultural Participation in 2020 and Future Participation in a Post-COVID Environment* report found significant levels of digital engagement with heritage organizations and museums (Ministry for Culture and Heritage 2021; The Audience Agency 2021). In the UK browsing online archives, record offices or online cultural collections and utilizing virtual tours of museums were the second and third most popular form of online arts and cultural activities, with watching live entertainment and performances (plays, dramas, musicals, and music gigs) in first place (The Audience Agency 2020b). This research suggests that during COVID-19 museums were delivering online content and the public "users" were accessing and engaging with this content.

The museum sector's shift to digital could have the potential to support museums to reach more diverse audiences, including non-traditional audiences and those who have never previously visited the museum, whilst supporting existing audience engagement. Interviews conducted during the COVID-19 pandemic with museum professionals in the UK and US revealed that the pandemic highlighted "ways in which digital technologies can be used to overcome the threshold anxieties of entering the physical museum, to connect, widen reach, and produce attendance numbers that far exceed on-site events" (Noehrer et al. 2021). A Digital Audience survey of museum/heritage website visitors indicated that 61% of first-time website visitors and 35% of high-

frequency website visitors had only engaged with the organization digitally and never in person (The Audience Agency 2020d). The survey also indicated that 18% of digital museum and heritage audiences identified as having a disability, compared to 10% of in-person visitors to museums, suggesting that digital resources potentially provide a more accessible medium to engage for visitors with a disability (The Audience Agency 2018). Data indicated that the museum and heritage sectors outperformed other cultural sectors in keeping and increasing visitor's engagement during the pandemic; this included a high proportion (around 33%) of visitors who indicated that their visit frequency had increased significantly since the COVID-19 crisis (The Audience Agency 2020c).

Digital research demonstrated that despite the inability to provide physical access to museums and heritage during COVID-19, many heritage organizations including museums attempted to engage with audiences through increased online access to provisions. A digital focused visitor access approach increased online visitors, audience diversity, and return rates of online visitors. This potentially indicated that museums use of digital provisions and support of visitor engagement through digital technology might not or even should not be a short-term reaction to the COVID-19 pandemic but may provide a sustainable future strategy for public inclusivity, access, and engagement. It is this shift to digital museum practices during COVID-19, and its impact on public/user wellbeing which is the focus of this research.

A consequence of the global pandemic, and the resulting social isolation from various phases of lockdowns, restrictions, and increased anxiety, fear, and loss, has been the impact on individual's wellbeing (Helliwell et al. 2021; OECD 2021; Perkins 2020; Williams II et al. 2020). Wellbeing has been attributed to a combination of physical, social, and psychological variables, often centered around four self-perceived characterizes of wellbeing: subjective or personal wellbeing, happiness, life satisfaction, and quality of life. Wellbeing is in a constant state of flux, and specific actions and cultural contexts such as the pandemic or even museums practices such as providing digital access can influence an individual's and specific social group's states of wellbeing. The New Economics Foundation (NEF) suggests that personal wellbeing comprises of feeling good and functioning well. An individual who views their life as a positive experience are happy and content, and feel enjoyment, engagement, and curiosity; their relationships are positive, they consider that they have control over their life and a sense of purpose (Aked et al. 2008). The NEF's National Accounts of Wellbeing Framework, created from research investigating the individual experiences of over 40,000 people across 22 countries, further developed this concept and suggested personal wellbeing is made up of five main indicators: emotional wellbeing (experiencing positive feelings and the absence of negative feelings); satisfying life; vitality; resilience and self-esteem (including optimism); positive functioning (including autonomy, competence, engagement, meaning, and purpose) (Michaelson et al. 2009). The NEF suggests there are five steps an individual can take to improve or sustain their wellbeing, known as the "Five Ways to Wellbeing" and promoted by the UK's National Health Service and mental health charities (Aked et al. 2008; Mind; National Health Service):

- (1) Connect: with those around you, including family, friends, neighbors, and colleagues
- (2) Be active: keep physically active

- (3) Take notice: be aware and curious of the world around you and how you feel
- (4) Keep learning: complete a challenge, try something new, or rediscover old interests
- (5) Give: volunteer, do something nice, give something back to the community and those around you

The COVID-19 pandemic had a significant impact on wellbeing; the UK's Office of National Statistics (ONS) Opinions and Lifestyle Survey results indicated that during the COVID-19 pandemic average levels of personal wellbeing fell, the number of people experiencing very low levels of wellbeing increased and happiness and anxiety levels in the UK population remained significantly worse than pre-pandemic levels (Office for National Statistics 2021, 2020). Public Health England's *COVID-19 Mental Health and Well-being (MHW) Surveillance* report also suggested that the pandemic resulted in a substantial rise of symptoms of mental ill-health (Perkins 2020). This was not unique to the UK: research conducted by the Commonwealth Fund found high levels of mental distress, including stress, anxiety, or sadness, in the populations of the United States, the UK, Canada, France, New Zealand, and Australia, and moderate levels in the Netherlands, Norway and Sweden (Williams II et al. 2020). These findings were mirrored in other international research such as the *World Happiness Report* and the Organisation for Economic Co-operation and Development reported that the prevalence of anxiety and depression more than doubled compared to pre-pandemic levels in many countries, for example (Helliwell et al. 2021; OECD 2021). Such research demonstrated that the COVID-19 pandemic increased mental health inequality, particularly in young adults, women, low-income households, the unemployed, families with children, and adults with pre-existing mental and physical health conditions (Helliwell et al. 2021; OECD 2021; Perkins 2020; Williams II et al. 2020). The negative impact of the COVID-19 pandemic on wellbeing has been substantial and has increased wellbeing inequality.

Since the late 2000s, the relationship between museum engagement and individual's wellbeing has become an emerging field of study. Museum and wellbeing research was pioneered by Chatterjee, Vreeland, and Noble (2009), who investigated the impact of handling museum objects on the wellbeing of patients in healthcare settings. Multiple high-quality, rigorous research studies have since demonstrated that heritage and museums (including alternative types of outreach, learning, and volunteering) have had a largely positive and transformative impact on the participant's wellbeing, including increased social connectivity, confidence, and life satisfaction (Pennington et al. 2019). The Imperial War Museum North & Manchester Museum's heritage volunteering program "Inspiring Futures," for example, demonstrated that engaging with heritage had long-term wellbeing impacts, with over 75% of volunteers reporting a significant increase in wellbeing in the first year and nearly 60% of participants sustaining increased wellbeing over a period of 2–3 years (Garcia and Winn 2017). However, research to date investigating the relationship between heritage engagement and wellbeing has been limited to accessing physical participation, such as object handling sessions (Chatterjee and Noble 2009; Chatterjee, Vreeland, and Noble 2009; Fujiwara 2013; Garcia and Winn 2017; Manchester Museum and Imperial War Museum North 2010).

Research examining an individual's motivations for accessing heritage digitally during the COVID-19 pandemic indicated 55% of online visitors to museum and heritage organizations engaged to "boost their mood" and 37% engaged to "reduce stress and anxiety"

(The Audience Agency 2020d). This suggested that these users felt digital engagement with heritage could have a positive impact on emotional wellbeing (a key National Accounts Framework indicator to support their personal wellbeing) and a desire to improve their wellbeing was the motivating factor for their use of digital resources. However, despite the potential of heritage to support improved wellbeing, the desire of users to digitally engage to improve their wellbeing and the movement of heritage engagement activities to online, the unique and potentially significant impact of digital heritage engagement on user wellbeing has not been consistently, strategically, or systematically studied. The pilot research presented in this paper seeks to contribute to this challenge by testing a new methodology to collect and analyze quantitative and qualitative data to start to deconstruct the specific humanistic values of digital museum resources and virtual engagement, on personal wellbeing. It sought to begin to understand the role that digital resources had on improving an individual's wellbeing during a global pandemic, a unique contextual situation, in which individual life satisfaction was lower, and depression and anxiety levels were higher than normative reported averages and at the same time physical access to heritage sites was largely restricted (Fancourt et al. 2020a, 2020b).

Methodology

The Digital Museums and Wellbeing pilot study was launched in May 2020 in response to the museum and wider heritage sector's shift to digital. The project critically measured the impact of digital museum resources on personal wellbeing during the COVID-19 pandemic using adapted public health care accredited measurements for wellbeing. This evaluative approach was based on subjective non-western holistic, social anthropological, and humanistic concepts of wellbeing, in which heritage has social and uniquely personal impacts on wellbeing (Aked et al. 2008; Michaelson et al. 2009; Tesfazghi, Martinez, and Verplanke 2010; Veronese et al. 2017). The research took a pragmatic, positivist, and humanistic approach to investigate the impact of digital museum practices on user subjective wellbeing. The process of engaging with digital museum resources was considered as an ethnographic process, and users' virtual experiences within the digital museum setting perceived as impacting their lives, including personal wellbeing indicators (as specified by the National Accounts Framework). The application of mixed method data collection to evaluate personal individual user experiences of digital museum resources during a pandemic considered the unique impact of digital engagement to user wellbeing. The project's application of a positivist approach, grounded in social and health science-based measurements collected of social value data, specifically wellbeing, can begin to provide evidence of the potential impact of digital museum resources on society during the COVID-19 pandemic.

This pilot research applied a pre-post data collection and analysis approach; surveys were collected before and after participants visited one or more of 11 digital museum sites to seek to establish stronger significant relationships and evidence of change. This pre-post visitation data collection design increased the likelihood that the intervention, in this case engaging with digital museum resources, impacted on, and changed individual's wellbeing during the COVID-19 pandemic (Thiese 2014, 205). The approach reduced the likelihood of extraneous variables, those variables that were not being investigated

but which may have impacted the results and/or changed at the same time as the intervention, causing changes in wellbeing (Leavy 2017, 68).

The mixed method approach ensured that results were not limited by specific methodological disadvantages. It sought to maximize data collected and variation of data and be contextually applicable. Qualitative approaches included informal non-leading open-ended questions. Incorporating qualitative data permitted detailed personal value analysis, investigation of specific impacts on wellbeing and helped determine context and specific reasons for improved wellbeing. Quantitative tested public health methodological frameworks of wellbeing and mental health assessments, such as the Positive and Negative Affect Schedule (PANAS) and Modified Wellbeing Survey (MWS) were used to assess the impact of digital museum resources on wellbeing during the COVID-19 pandemic.

The PANAS survey was developed by Watson, Clark & Tellegen in 1988 as a response to unreliable, inefficient, and invalid earlier widely used Negative Affect and Positive Affect scales. The survey measured wellbeing through listing 10 words relating to positive emotions (such as enthusiastic, strong, inspired) and 10 words relating to negative emotions (distressed, irritable, ashamed, for instance). Participants were asked to select how they felt these words applied to them on a numbered five-point Likert scale (from 1 – very slightly or not at all to 5 – extremely). PANAS was developed to allow use of the scale repeatedly and/or within a longitudinal study; the researcher can insert different time periods from “present moment” to “past year” into the survey questions. This study, for example, asked participants how they felt a word (such as “attentive”) applied to them when “thinking about yourself and your experience today.” When multiple PANAS scales are administered, as they were in this study, change in scores can demonstrate changes over the period between the completion of surveys.

Sayer developed the Modified Wellbeing Scale (MWS) from a modified version of a Visual Analog Scale (VAS) produced by Thomson, Ander, Menon, Lanceley, and Chatterjee (Sayer 2018). The MWS measures subjective wellbeing and happiness and incorporates elements from the VAS, the General Health Questionnaire (GHQ), four UK Office for National Statistics wellbeing questions (based on the New Economic Foundation’s Five Ways to Wellbeing) and the Warwick Edinburgh Mental Wellbeing Scale (Aked et al. 2008; Goldberg and Hillier 1979; Office for National Statistics 2018; Warwick Medical School 2021). Participants were given a series of four questions relating to connection to others, interest in the world, life satisfaction, and personal happiness (e.g., When considering your personal happiness, at the moment how happy would you rate yourself?) and asked to select how they felt on a ten-point Likert scale. Sayer (2015) successfully trialed combining PANAS and MWS in two projects investigating the impact of public archaeology on adults’ and children’s wellbeing.

The Positive and Negative Affect Schedule (PANAS) and Modified Wellbeing Scale (MWS) have been tested and refined for use within a heritage context. They have subsequently been used internationally to quantitatively evaluate multiple in-person heritage wellbeing projects and have proved to be effective in measuring wellbeing in a variety of heritage contexts (Sayer 2018). As a result, both the MWS and PANAS were used in this study to assess the wellbeing of individuals before and after their visit to one or more of 11 pre-selected digital museum resources sites (Table 1).

Table 1. Table presenting museums used in this research.

Organization	Location	Website	Type of resource available
British Museum	UK	https://www.britishmuseum.org/collection	Large Online Collection
National Museum of Natural History	USA	https://naturalhistory2.si.edu/vt3/NMNH/	Virtual Tour
The Louvre	France	https://www.louvre.fr/en/online-tours	Virtual Tour
Acropolis Museum	Greece	https://artsandculture.google.com/partner/acropolis-museum?hl=en	Virtual Tour and Limited Online Collection
Rijksmuseum	Netherlands	https://artsandculture.google.com/partner/rijksmuseum	Virtual Tour, Large Online Collection and Online Exhibit
Tate Britain	UK	https://artsandculture.google.com/partner/tate-britain	Virtual Tour, Limited Online Collection and Online Exhibit
The State Hermitage Museum	Russia	https://artsandculture.google.com/partner/the-state-hermitage-museum?hl=en	Virtual Tour and Large Online Collection
National Gallery of Victoria	Australia	https://artsandculture.google.com/partner/national-gallery-of-victoria	Limited Online Collection and Online Exhibit
The National Museum in Krakow	Poland	https://artsandculture.google.com/partner/the-national-museum-in-krakow?hl=en	Virtual Tour, Limited Online Collection and Online Exhibit
The Metropolitan Museum of Art	USA	https://artsandculture.google.com/partner/the-metropolitan-museum-of-art?hl=en	Virtual Tour, Large Online Collection and Online Exhibit
Tokyo National Museum	Japan	https://artsandculture.google.com/partner/tokyo-national-museum	Virtual Tour, Limited Online Collection and Online Exhibit

The selection of websites was based on a heterogeneity sampling strategy as museums varied widely and provided a broad range of topics, time periods, and contexts (Leavy 2017, 81). The type of digital museum resource (such as virtual tour of a museum, an online exhibition, or browsing a digitized collection) available for each museum also varied; many museums offered multiple types of resources (Table 1). These criteria ensured this pilot study's initial results were widely applicable to the sector and to global digital heritage approaches.

The pilot project's call for participants was widely advertised via social media campaigns on Instagram, Facebook, and Twitter, and existing community, student, academic and professional networks across the globe. Participants were required to be over the age of 18, but no other exclusion or selection criteria were imposed. The call for participants invited individuals to take part in the research by completing an online "before" survey, visiting one or more of the above online heritage sites and engaging with whichever type(s) of resource they wished (such as online tour, collection, or exhibition), and then completing an online "after" survey. All information required to take part, including links to both surveys and digital museum resources, was provided in the call for participants and participants were invited to contact the researchers via email with any questions, however none did so. Email addresses were collected on the initial survey and participants contacted and reminded to complete the "after" survey if they had not done so within 2 days of submitting the "before" survey. Automatic withdrawal took place if participants did not complete both surveys as without this the comparison of well-being before and after interaction with digital museum resources could not be assessed.

This study received ethical approval from Manchester Metropolitan University's Ethics Committee, project no. 23858. All participants provided appropriate consent (after reading a Participant Information Sheet they were required to complete an online consent form) and consented to the use of their anonymized data for research purposes.

To assess the impact of digital museum resources on participant wellbeing during the pandemic, quantitative findings underwent numerical and statistical analysis. Percentage

differences between mean results (the percentage difference between before and after mean scores of PANAS words such as “attentive”) were calculated to give an initial impression of the impact of engagement with digital museum resources on wellbeing.

The range of results and the standard deviation from the mean were calculated to ascertain variability. The range demonstrated the spread of answers. The standard deviation demonstrated how far away on average each answer was from the mean average; the smaller the standard deviation, the more results were clustered around the mean and the less variability in the data. Range and standard deviation differences between the “before” data and the “after” data were calculated to assess whether variability had increased or decreased after engagement with digital museum resources during the COVID-19 pandemic. For example, the standard deviation of the “before” and “after” data for each measure on the surveys, such as “excited” on the PANAS survey, was calculated. Where the standard deviation was smaller in the “after” data, results were more clustered around the mean score and participants were deemed to have felt more similar levels of excitement after engagement with digital museum resources.

Statistical hypothesis testing was conducted to test the significance of quantitative results and the probability that the results were not a result of chance and showed a true reflection of the target population. Non-parametric related sample tests were applied, either Wilcoxon Signed Rank Test or the Pair-Sample Sign Test depending on whether the distribution of the differences between the two pairs was symmetrical in shape (Laerd Statistics 2021). These tests were used to determine statistically significant changes to individual wellbeing after engagement with digital museum resources during the COVID-19 pandemic. In all tests, the null hypothesis assumed that the median of differences between [measure (e.g., PANAS word such as “attentive”) pre-test] and [measure post-test] equaled 0. Results were deemed to be statistically significant when the p -value was below 0.05 (5%). The null hypothesis was therefore retained when the p -value of these tests was above 0.05, demonstrating no real change to wellbeing after engagement with digital museum resources, with 95% confidence. When the p -value of the Wilcoxon or Sign test was below 0.05, the null hypothesis was rejected. Results were determined to be highly significant below 0.01 (1%); the smaller the p -value, the stronger the evidence against the null hypothesis and confidence that the null hypothesis should be rejected (Donnelly Jr and Abdel-Raouf 2016).

The two-tailed test was conducted to test for change to wellbeing. The direction of change was determined by the greater number of positive or negative differences observed in matched pairs. If there were more positive matched pairs than negative, for example, the direction of change was determined to be positive. Thematic analysis based on the NEF “Five Ways to Wellbeing” and National Accounts Framework personal wellbeing indicators were used to ascertain any recurring themes in qualitative data submissions and the findings of both data sets were then combined to determine evidence-based conclusions.

Results

This pilot research was undertaken between April and August 2020. Fifty-seven participants completed the “before” survey. Twenty-three participants did not complete the “after” survey and were withdrawn. Thirty-four participants completed both surveys.

Most participants (89.19%) completed both “before” and “after” surveys within 24 hours, but in all cases, the “before” and “after” surveys were completed within 2 days. The majority of participants were located in the UK (27, or 79%), with a minority in India (6) and Palestine (1). Participants were aged between 20 and 62 at the time of taking part, with a median and mean average age of 35 and modal age of 22. Fifty visits were conducted in total to 10 museums (Figure 1).

Twenty-five participants (74%) elected to visit one museum’s digital resource, with the rest of participants digitally visiting between 2 and 4 museums. Where participants visited more than one museum, “after” surveys were submitted once they had completed all their visits. This enabled understanding of the impact of engaging with digital museum resources as a whole as opposed to the impact of visiting a specific museum. Twenty-six visits were to websites that only offered one type of digital museum resource (10 visits to National Museum of Natural History, 10 to The Louvre, both of which only offered virtual tours, and 6 to the British Museum’s full online collection). The rest of the visits were to websites which included a combination of digital resources. Participants spent between 10 and 180 minutes total taking part, with a median time of 30 minutes, mean time of 39 minutes, and modal time of 20 minutes.

Mean PANAS results indicated a mean average decrease of 18.02% across all negative factors measured after engagement with digital museum resources. Mean PANAS results suggest that all negative emotions were reduced after engagement, this included a considerable decrease in nervous (−27.93%), upset (−26.32%) and afraid (−25.33%) (Figure 2).

The range of results decreased for afraid, upset, guilty, ashamed, hostile, nervous, and irritable, demonstrating that the range of scores reduced for these negative measures after engagement with digital museum resources. The range was unchanged after engagement with jittery, distressed, and scared (Table 2).

The standard deviation around the mean decreased and was less variable for all PANAS negative factors, particularly in afraid (−50.48%), upset (−47.32%), guilty (−41.32%),

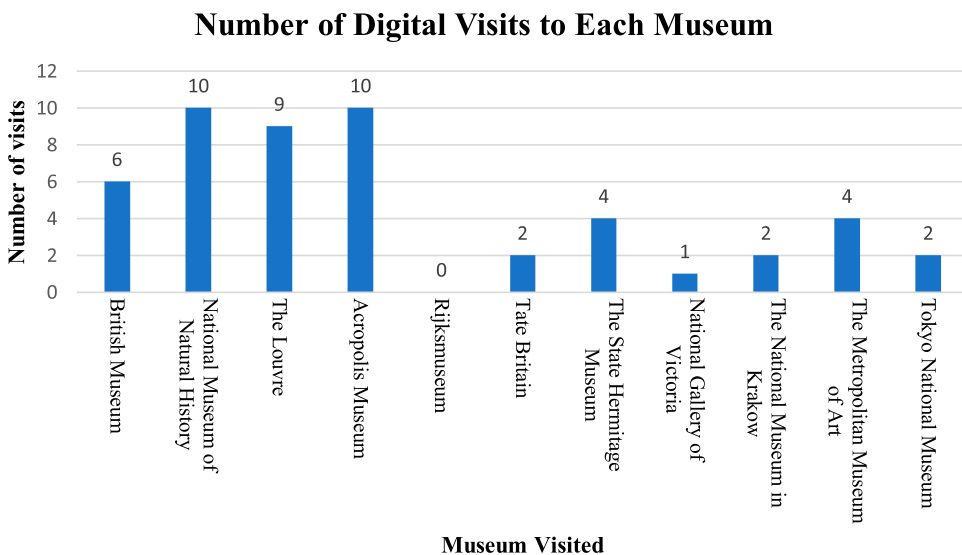


Figure 1. Bar graph showing number of digital visits to each museum.

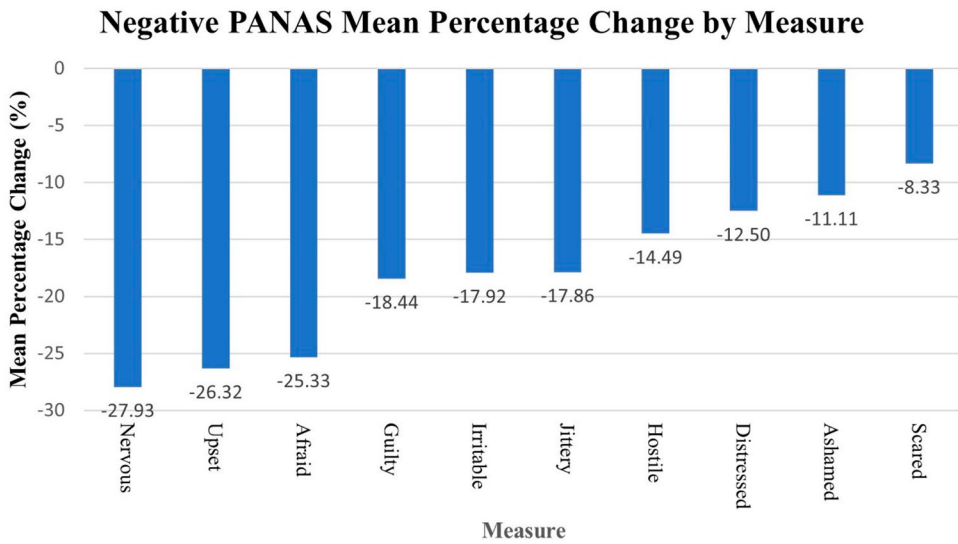


Figure 2. Bar graph of mean percentage change in PANAS negative measures

ashamed (−38.59%), hostile (−37.60%), nervous (−28.67%) and jittery (−26.61%). The amount of change in the standard deviation after engagement with digital museum resources varied considerably, suggesting that some attributes such as afraid, upset, guilty, ashamed, and hostile were more strongly impacted than others (Table 2).

Statistical analysis indicated that only changes to guilty ($p = .039$) and nervous ($p = .013$) were statistically significant and afraid was highly significant ($p = .004$) (Table 2). The direction of change was negative for all significant measures, suggesting these negative emotions were reduced after engagement with digital museum resources.

Table 2. Table presenting significance (p -value), standard deviation, and range change of PANAS measures.

Measure	SD change	Range change	SD percentage change (%)	Significance (p -value)
Afraid	−0.417	1	−50.48	0.004
Upset	−0.459	1	−47.32	0.057
Guilty	−0.307	1	−41.32	0.039
Ashamed	−0.257	1	−38.59	0.219
Hostile	−0.314	1	−37.6	0.289
Nervous	−0.289	1	−28.67	0.013
Jittery	−0.268	0	−26.61	0.146
Enthusiastic	−0.27	1	−24.22	0.027
Inspired	−0.296	0	−22.19	0
Irritable	−0.206	1	−17.17	0.167
Interested	−0.144	1	−15	0.019
Distressed	−0.084	0	−8.89	0.227
Scared	−0.043	0	−6.29	0.219
Attentive	−0.056	1	−6.28	0.001
Active	−0.038	0	−3.5	0.115
Excited	−0.006	0	−0.54	0.004
Determined	0.013	0	1	0.503
Alert	0.016	0	1.55	0.052
Strong	0.044	0	4.17	0.629
Proud	0.095	0	7.86	0.383

PANAS mean averages for positive measures indicated that all positive emotions increased after engagement with digital museum resources during the pandemic, with an average increase of 13.72%. This included particularly high increases in scores for inspired (+30.24%) and excited (+22.52%) (Figure 3).

After engagement with digital museum resources, the range of scores reduced for enthusiastic, interested, and attentive, demonstrating a narrowed breadth of scores for these positive measures. The range of scores was unchanged for inspired, active, excited, determined, alert, strong, and proud after engagement with digital museum resources (Table 2).

Standard deviation around the mean in PANAS positive measures varied after engagement with digital museum resources. SD was lower and less variable in most PANAS positive attributes, of particular note were changes to enthusiastic (−24.22%) and inspired (−22.19%). Yet, SD was slightly higher and more variable for determined (+1%), alert (+1.55%), strong (+4.17%), and proud (+7.86%) (Table 2). Differences in the amount of change experienced after engagement with digital museum resources signified that engagement had an increased impact on certain attributes such as enthusiastic, inspired, and interested. Statistical analysis determined that positive changes to enthusiastic ($p = .0297$) and interested ($p = .019$) were significant, and attentive ($p = .001$), excited ($p = .004$), and inspired ($p = .000$) were highly significant (Table 2).

MWS mean percentage differences indicated all categories increased by an average of 16.50%. There was considerable variation in mean increases across measures; connectedness increased by 23.58%, happiness by 20.93%, interested in the world by 14.10%, and life satisfaction by 7.40% (Figure 4).

The range of results only changed for happiness, which decreased and demonstrated the breadth of scores reduced after engagement with digital museum resources. The range for connectedness, life satisfaction, and interested in the world was unchanged

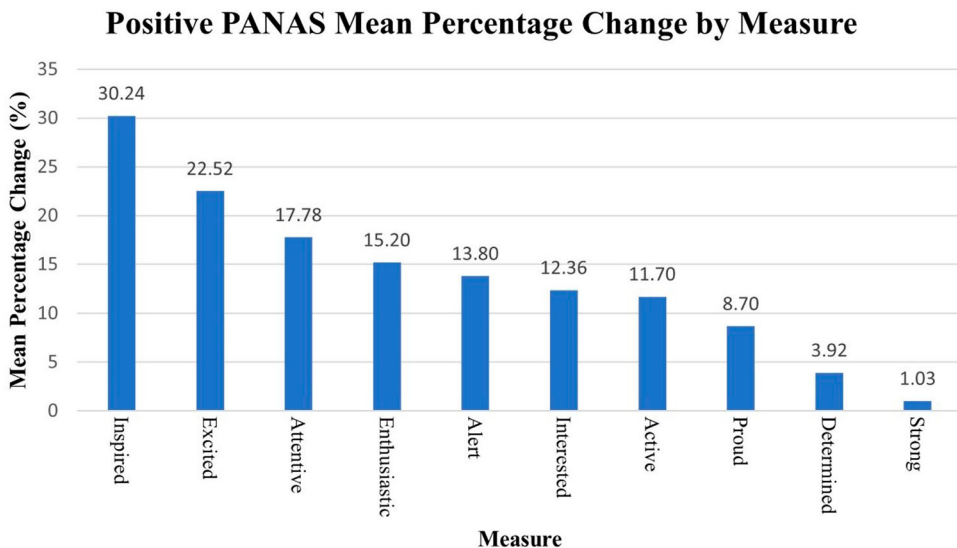


Figure 3. Bar graph showing mean percentage changes in PANAS positive measures.

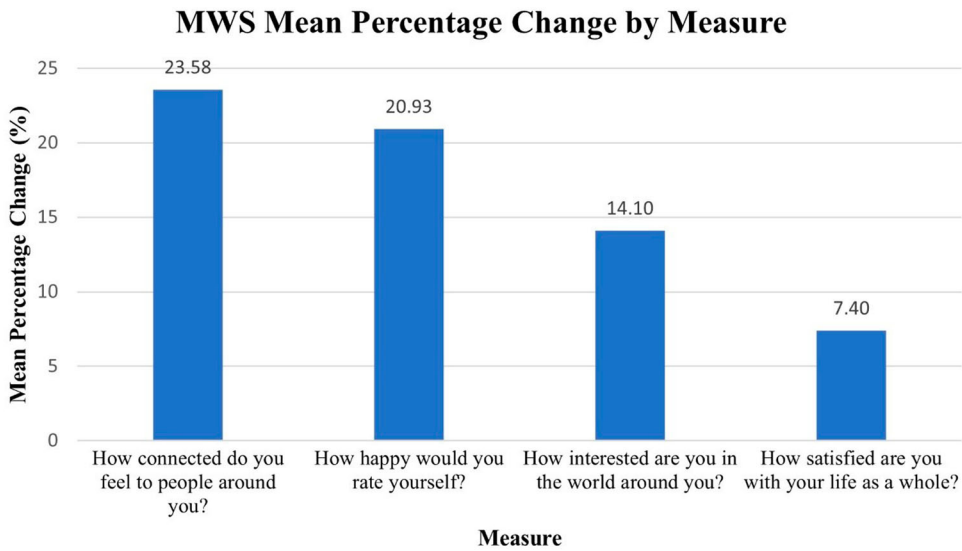


Figure 4. Bar chart presenting mean percentage change in MWS measures.

after engagement with digital resources. Standard deviation around the mean was lower and less variable after engagement with digital museum resources during the pandemic for all four MWS aspects. Yet, variability in results suggests digital museum resources had differential impact on MWS aspects, with interest having the largest reduction (-20.73%) (Table 3).

Statistical analysis suggests similar patterns; changes to all four categories were significant. Connected ($p = .000$), interested ($p = .000$) and happiness ($p = .000$) were determined to be highly significant and life satisfaction was significant ($p = .022$) (Table 3).

Discussion

Mean changes to PANAS and MWS results indicated that during the COVID-19 pandemic specific wellbeing traits related to personal wellbeing improved immediately after interaction with digital museum resources. Mean change results demonstrated all PANAS negative measures reduced, and all PANAS and MWS positive measures increased, suggesting that participant personal wellbeing had improved in the indicators measured via these surveys after engagement with digital museum resources. Results indicated that engagement with digital museum resources had measurable and considerable impact on National Account Framework indicators related to emotional wellbeing; this included

Table 3. Table presenting significance (p -value), standard deviation, and range change of MWS measures.

Measure	SD change	Range change	SD percentage change (%)	Significance (p -value)
Interested in the world around you	-0.478	0	-20.73	0
Happiness	-0.386	2	-15.59	0
Connectedness	-0.302	0	-11.42	0
Life satisfaction	-0.019	0	-0.85	0.022

substantial mean average reductions in being nervous, upset, afraid, and increases in being excited, inspired, connected, and happy.¹ Respondents felt little increase in feeling strong after participating in an online activity, which underwent the least change (+ 1.03%) across all measures, suggesting digital museum resources did not have a significant impact on physical wellbeing; specifically National Accounts Framework indicator vitality and “5 Ways to Wellbeing” criteria be active.

Analysis of the range and standard deviation produced more nuanced findings but demonstrated trends in emotions amongst the group of participants. A reduction in range and reduced standard deviations for many of the measures demonstrated that variability largely narrowed after engagement with digital museum resources. Responses were generally more clustered around the mean after engagement with digital museum resources, suggesting increased consensus and more similar feelings amongst all participants. Consensus across the group suggests the findings of this study are reliable. However, disparity between the amount of standard deviation reduction across measures suggested digital museum resources had increased impact on certain wellbeing traits and measurements; specifically, on afraid, guilty, upset, ashamed, hostile, nervous, jittery, and increasing feelings of feeling enthusiastic, inspired, and interest in the world around them.² These results suggest digital museum resources supported National Account Framework indicators for personal wellbeing, including emotional wellbeing and positive functioning, and supported the NEF’s “5 Ways to Wellbeing” specifically supporting users to take notice and potentially keep learning through being inspired.

Statistical analysis indicated that during the COVID-19 pandemic digital museum resources had an immediate statistically significant impact on specific wellbeing traits; it suggested that engaging with digital museum resources during the pandemic enabled participants to feel happier, more connected to, and interested in the world around them, increased life satisfaction, less nervous, afraid, and guilty, and more interested, enthusiastic, attentive, excited, and inspired, suggesting that digital museum resources supported the NEF’s “5 Ways To Wellbeing” to connect, take notice and potentially keep learning and supported National Accounts Framework personal wellbeing indicators, including emotional wellbeing, satisfying life and positive functioning.

20.58% of participants (7 people) elected to answer the qualitative survey questions. These limited responses indicated visitors enjoyed the digital museum resources “Those museums were amazing and loads of fun, I especially liked the National History Museum which made me feel so enthusiastic it was so bright and colourful” and “I enjoyed touring the Louvre and the National History Museum”. These comments further substantiate the PANAS survey findings; particularly that enthusiasm increased significantly and suggested engaging with digital museum resources supported National Account Framework indicator of emotional wellbeing and “5 Ways to Wellbeing” take notice.

Participants noted that certain elements of virtual tours, such as online gift shops, made them feel like they were on a “proper” tour “I liked being able to have a look at the gift shop at the end of my tour in the National History Museum, it made it feel more like a proper visit”. These comments implied that in-person engagement was still regarded as the “proper,” and potentially the preferred, way of engaging with heritage. Visitors noted that they still wanted to visit in person, despite the availability of online tours “I would love to visit the places in person” and felt an in-person experience

would have made more of an impact on their wellbeing “probably would have had more of a change had I visited these museums in real life” . Qualitative results suggest that whilst users were entertained by digital experiences, they perceived them as less valuable than the physical experience of visiting a museum. These findings potentially mirror recent findings of audience’s experiences of digital cultural content during lockdown (The Audience Agency 2020a).

Qualitative results indicated that external factors negatively impacted individual wellbeing, including COVID-19 and current world circumstances, “I am feeling more negative emotions than normal due to current circumstances”. These external factors effected participant enjoyment and positive perceptions of digital museum resources, this included their ability to take notice, and their personal wellbeing, specifically their emotional wellbeing and positive functioning “I feel at the moment I don’t have the mental capacity to be able to enjoy a museum, in real life or virtually. I just feel like our world has shrunk and everything is much more intense”. Mirroring international wellbeing reports that indicate that individual wellbeing was below average during this period of the pandemic, participants’ wellbeing was also noticeably lower across all quantitative metrics at the outset of this study compared to previous studies which evaluated the impact of engaging with heritage in person and had similar participants (students, and members of the public) in 2015 (Sayer 2015). Although participants are not directly comparable, this does offer some indication of changes in overall wellbeing from 2015 to 2020. All negative measures listed on the PANAS were more pronounced and all positive measures were reduced at the start of this study compared to scores collected at the start of in-person heritage projects. The participants from this study felt more nervous, upset, afraid, guilty, irritable, jittery, hostile, distressed, ashamed, and scared and less proud, strong, inspired, alert, excited, attentive, determined, enthusiastic, active, and interested at the outset of this study than participants taking part in physical heritage engagement studies in 2015 (Table 4). Participants taking part in this study reported feeling lower life satisfaction, less interest in the world around them and considerably less connected and happy

Table 4. Table presenting the mean starting scores of in-person and digital PANAS measures.

Measure	Mean starting score in-person (5-point Likert scale)	Mean starting score digital (5-point Likert scale)
Strong	3.48	2.91
Determined	3.8	3.06
Proud	3.06	2.76
Active	4.07	2.82
Interested	4.3	3.56
Alert	3.56	2.97
Enthusiastic	3.88	3.29
Attentive	3.79	3.15
Excited	3.6	2.62
Inspired	3.52	2.91
Nervous	1.48	1.79
Upset	1.13	1.71
Afraid	1.19	1.5
Guilty	1.2	1.41
Irritable	1.51	2.12
Jittery	1.28	1.68
Hostile	1.22	1.38
Distressed	1.24	1.68
Ashamed	1.11	1.26
Scared	1.19	1.32

than participants of pre-COVID-19 heritage and wellbeing research (Table 5). Lower pre-engagement baseline scores for participant wellbeing demonstrated the impact of external factors on individual wellbeing.

Limitations

This pilot research assessed the efficacy and suitability of a research design and methodology, one that had previously only been applied to in-person heritage and museum engagement. Despite the research design and methodology success, and yielding of significant results despite the small sample, limitations were identified. Few participants elected to answer qualitative questions which limited the ability to draw robust conclusions from this data. To help improve the number of responses, in future qualitative questions will be more focused to resemble in-person informal conversations more closely.

In future, the project aims to develop partnerships with a wider range of museum and heritage organizations and embed the “before” and “after” surveys at the start and end of a variety of pre-existing online resources, such as virtual tours, online collections, or exhibitions. Whilst considerable effort was made to select a diverse range of museums, the websites that participants were guided to were mainly those of large nationally funded organizations. At the outbreak of COVID-19 these museums were in a unique position to have both the resources and the financial ability to be responsive to the pandemic and prioritize digital museum resources. Large national organizations thus had digital resources which were freely available and accessible when this study was launched and were therefore selected for this study out of necessity. This concentration on one type of heritage organization impedes the generalization of these findings to the sector as a whole. Working with a more varied group of museums and heritage organizations in the future would reduce this limitation.

It was not possible within this research to assess which specific digital resources (e.g., virtual tour, online collection) were most impactful as some participants visited multiple museums digitally, some websites offered multiple types of digital resource and participants were not asked which type of digital resource they engaged with. In future research, participants will be asked to clarify what type of resource they engaged with, to enable further investigation into differential wellbeing impacts amongst resource types.

There were a range of advantages to soliciting participants to visit digital museum sites, such as the inclusion of diverse participants and non-normative museum visitors. However, it is acknowledged that individuals who are interested in heritage engagement may have been more likely to volunteer to take part after seeing the call for participants on social media, which may result in an element of bias in this initial study. In future, research will ask participants how frequently they visit museums to further explore this.

Table 5. Table presenting the mean starting scores of in-person and digital MWS measures.

Measure	Mean starting score in-person on 10-point Likert Scale	Mean starting score digital on 10-point Likert Scale
Connected	7.31	5.09
Happy	7.4	5.59
Satisfied	7.64	6.35
Interested	7.85	6.88

In addition, the limited data the pilot project collected indicated that also embedding surveys in museum organization's websites could increase data and produce a geographically and demographically nuanced picture of the wellbeing impact of existing digital museum resource users. Increased data and wider sampling strategy will enable exploration of the influence of participant demographics on the wellbeing impact of digital museum resources; this research was unable to investigate if different demographics felt different wellbeing impacts after engaging with digital resources due to the small sample size. This is an important avenue of inquiry given the COVID-19 pandemic's recognized impact on wellbeing inequality and will be the focus of future research. Future research will seek to both solicit visitors and embed surveys in more diverse museum and heritage organizations' websites to ensure both diverse participants and increased data.

This research highlighted the complexities of understanding participant personal wellbeing. It suggested wellbeing increased immediately after engagement with digital museum resources during the pandemic in specific ways. Specifically, engagement with digital museum resources during the pandemic had no negative impact on emotions and resulted in statistically significant increased life satisfaction, happiness, connectedness, interest, enthusiasm, attentiveness, excitement, inspiration, and reduced feelings of nervous, afraid, and guilty. These wellbeing impacts may be unique to digital museum resources; the research was unable to determine if large-scale improvement to wellbeing after engagement with digital museums resources was specific to this current context. Further research, post pandemic, is needed to ascertain the full extent of the impact of digital museum resources on wellbeing and to assess the differential wellbeing impact of digital and physical engagement and explore comparative social values.

Conclusion

The initial results from this pilot research indicated that engaging with digital museum resources, specifically virtual tours, online collections, and exhibitions, during a pandemic was beneficial to user's personal wellbeing. These digital museum resources had a measurable and significant positive impact on users' personal wellbeing; specifically, they supported the New Economics Foundation's (NEF) Five Ways to Wellbeing, enabling users to connect, take notice and potentially to learn, and National Account Framework indicators of emotional wellbeing, satisfying life and positive functioning.

The low initial wellbeing score from participant's indicated that engaging with digital museum resources could be a useful mechanism to support those struggling with pre-existing mental health conditions and as such a potential tool for social prescribing (Culture Health and Wellbeing Alliance 2021). The wider use of digital resources within the museum and heritage sector could provide a social activity to support wellbeing and mental health, offering an alternative and holistic approach instead of, or in addition to, more conventional forms of medicine. Whilst further research with larger sample sizes is required in the future, this pilot research suggested that digital resources can be useful tools for museums to support individual's personal wellbeing.

Given their impact on individual wellbeing, digital resources could provide museums and potentially more broadly heritage organizations with the tools to support local and national wellbeing agendas. They could act as mechanisms to improve wellbeing at a

global level through decentralizing and globalizing heritage practices. If museums develop digital strategies that consider this mode of public communication, presentation, and engagement as a mechanism to impact wellbeing, they could play a role in reducing wellbeing inequality and supporting global sustainable development goals and agendas linked to wellbeing. However, it is necessary to acknowledge that whilst digital museum resources may have the potential to support these global goals, due to a marked digital divide between developed and non-developed countries (approximately 80% of the population have access to the internet in advanced economies, compared to only 35% in developing countries), digital museum resources specifically are currently unlikely to be representative and have an equal impact on wellbeing globally (The World Bank 2021; United Nations 2019). Furthermore, there is a significant gender disparity in terms of access to technology; approximately 327 million fewer women than men have a smartphone and can access the mobile Internet (OECD 2018). This disparity suggests that digital methods of engaging with heritage may also be unable to have an equal impact on women's wellbeing across the world.

The future role of digital technology in both the museum profession and to improving users' wellbeing will be determined by the lessons learnt and actions taken during the COVID-19 pandemic. Specifically, on the ability and desire of museums to adapt their practices based on professional experiences, self and collaborative reflection, and evaluation. This approach could enable consideration of the priorities of the organization alongside wider societal requirements, needs, and wants. This initial research suggests that digital methods of engagement should be fostered and developed as an additional resource and alternative choice rather than a replacement to physical engagement; whilst further research is required, these initial results indicate that digital resources have a measurable and significant impact on people's personal wellbeing.

Notes

1. These measures experienced over 20% change after engagement with digital museum resources.
2. These measures experienced SD change of over 20% after engagement with digital museum resources.

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