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Article abstract

Distance learning has become an important tool in many fields of education. Museums, like other educational institutions, have been offering distance learning programs to their audiences for more than 30 years. This scoping study examined the published literature related to distance learning programs in museums to inform future research in this field. Searches were conducted in three academic databases in addition to journal hand searches. This resulted in 954 unique citations associated with distance learning in museums. Of these, 17 articles met the criteria for inclusion in the study. Forwards and backwards searches resulted in the addition of two books. A search of the research hosted by the Center for Advancement of Informal Science Education resulted in one additional study for a total of 20 manuscripts. Upon analysis, four major themes were identified. These included benefits and barriers related to distance learning programs in museums, partnerships, and educators' changing roles as they relate to distance learning programs. Each of these themes is described and areas for future research are identified. Future work should move beyond the predominately evaluative case studies and pursue larger questions about how future research might support museums as they continue to design and implement online programming. This may include exploring best practices in museum-based distance learning and how to develop effective professional development opportunities for the educators engaged in these programs. Such research will enhance museum-based distance learning programs so that they can continue to support global learners.

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Distance Learning in Museums: A Review of the Literature

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Abstract

Distance learning has become an important tool in many fields of education. Museums, like other educational institutions, have been offering distance learning programs to their audiences for more than 30 years. This scoping study examined the published literature related to distance learning programs in museums to inform future research in this field. Searches were conducted in three academic databases in addition to journal hand searches. This resulted in 954 unique citations associated with distance learning in museums. Of these, 17 articles met the criteria for inclusion in the study. Forwards and backwards searches resulted in the addition of two books. A search of the research hosted by the Center for Advancement of Informal Science Education resulted in one additional study for a total of 20 manuscripts. Upon analysis, four major themes were identified. These included benefits and barriers related to distance learning programs in museums, partnerships, and educators' changing roles as they relate to distance learning programs. Each of these themes is described and areas for future research are identified. Future work should move beyond the predominately evaluative case studies and pursue larger questions about how future research might support museums as they continue to design and implement online programming. This may include exploring best practices in museum-based distance learning and how to develop effective professional development opportunities for the educators engaged in these programs. Such research will enhance museum-based distance learning programs so that they can continue to support global learners.

Keywords: museums, online learning, distance learning, literature review

Introduction

Interest in distance learning programs has increased since the outbreak of COVID-19 and the global closure of schools (Butcher, 2020). There is a wide range of definitions for distance learning due to technology changes over time and differences in implementation (Moore et al., 2011). Distance learning is often used as a blanket term that includes "online learning, e-learning, technology mediated learning, online collaborative learning, virtual learning, web-based learning" and so on (Moore et al., 2011, p. 130). Even so, the many definitions agree that distance education occurs between at least two people at different times and/or places using a wide range of resources (Moore et al., 2011).

There have been many studies on the benefits and challenges of distance learning (e.g., Fadde & Vu, 2013; Kaplan & Haenlein, 2016; Nortvig et al., 2018; Pulham & Graham, 2018; Watts, 2016). One of the major strengths of distance learning is the increased access for audiences who may otherwise face barriers to education. However, there are challenges related to the lack of technology, increased workloads for the educator and learner, or even loss of instructional flexibility (Fadde & Vu, 2014). While much research has been carried out on distance learning at the university level (e.g., Nortvig et al., 2018; Singh & Hurley, 2017) and in K–12 settings (e.g., Moore-Adams et al., 2016; Pulham & Graham, 2018), there is still much to be learned about distance learning in museums.

In the United States, "museums spend more than $2 billion a year on education . . . [and] provide more than 18 million instructional hours for educational programs" (American Alliance of Museums, 2021, para. 5). While museums are important spaces for learning, there are still concerns about access. For adults who are interested in visiting museums but do not, access (e.g., cost, distance, accessibility) is one of the largest barriers (Dilenschneider, 2019). To reach broader audiences, some museums have begun offering distance learning programs. These programs allow museums to increase their reach through technology that is becoming more ubiquitous (Kraybill, 2015).

During the 2020 COVID-19 school closures, the United States suddenly transitioned from supporting nearly one million students enrolled in online learning to more than 55 million students (Butcher, 2020). Rather than creating new content, schools were encouraged to partner with organizations, such as museums, already offering online materials (Butcher, 2020). Since the outbreak of COVID-19, museums have increased their online offerings, however, many museum educators are not confident in their ability to produce high-quality online materials (Ennes, 2021). As more museums begin offering online programs, there is a need to examine the current research regarding distance learning in museums. This article provides an overview of the current literature surrounding distance learning in museums and areas in need of further research. This study was guided by the following research questions:

1. What is the current state of research regarding distance learning in museums?

2. What themes are apparent in the existing research on distance learning in museums?

The purpose of this study was to establish a foundation for future work examining distance learning in museums. For example, this review was used to inform a study of distance learning in museums before and after museum closures due to COVID-19 (See Ennes, 2021).

Methods

For this study, a distance learning program was defined as any museum program conducted by an educator via the Internet with audiences at offsite locations. This definition excluded virtual museums (Schweibenz, 2004) or virtual field trips that "are basically Websites that include text, audio, or video resources about specific topics" (Zanetis, 2010, p. 20). Additionally, digital games and educational apps designed by museums were not included in the search as they provide no engagement with an educator.

To better understand the current state of the research surrounding distance learning in museums, we conducted a scoping study (Arksey & O'Malley, 2005). Scoping reviews can "provide a snapshot of the field and a complete overview of what has been done . . . identify the conceptual boundaries of a field, the size of the pool of research, types of available evidence, and any research gaps" (Xiao & Watson, 2019, p. 99). Additionally, scoping reviews clarify definitions and map the major concepts surrounding a topic (Peters et al., 2015). Scoping reviews can be used to summarize and publish results of research, particularly for those who might not have the ability to review the literature themselves; they also identify gaps in the literature for future studies (Arksey & O'Malley, 2005).

Literature Search

This study began in September 2019 with a search of the following multidisciplinary electronic databases: Web of Science, EbscoHost, and Eric (ProQuest). Each of these databases has been empirically tested and identified as being appropriate for use as principal search systems when conducting literature reviews (Gusenbauer & Haddaway, 2020). Keywords were identified based on literature identified for a previous study (Ennes, 2015). The following keywords were used: museum, combined with one of distance learning, distance education, virtual field trip, or virtual fieldtrip. The variations on the term virtual field trip were included because some early articles referred to distance learning programs as virtual field trips (e.g., Bradford & Rice, 1996). However, any article that referred to a virtual field trip in the form of a static, self-directed online tour of a museum or other location was excluded (e.g., Kenna & Potter, 2018; Zanetis, 2010). This search led to an initial field of 220 papers with 13 duplicates for a total of 207 potential articles.

Following the database search, we conducted three journal hand searches (Alexander, 2020). First, we searched a major university's catalog of journal titles for any title that included the word museum. We identified a total of 10 journals to be hand searched. While it did not show up in the journal search, the *Journal of Museum Education* was added to this list for a total of 11 (Table 1). The journal hand search resulted in 54 potential articles with 10 repeated articles for a total of 44 new articles; 17 were kept for a full read based on the criteria outlined in Figure 1.

Table 1

Journals Included in Museum Journal Hand Search

Journal	Hits	Articles kept
Curator: The Museum Journal	13	4
International Journal of Cultural Studies	2	1
International Journal of the Inclusive Museums	0	0
Journal of Conservation and Museum Studies	0	0
Journal of Cultural Studies	0	0
Journal of Museum Education	31	12
Journal of Museum Studies	1	0
Museum International	6	0
Museum and Society	1	0
Museum Worlds: Advances in Research	0	0
Museums and Social Issues	0	0
Total	54	17

To broaden our search, we did a third search for additional journals that might publish articles on distance learning or museums. To do this, we searched the InCites Journal Citation Reports for journals related to education and educational research (n = 243); computer science, interdisciplinary applications (n = 106); social sciences, interdisciplinary (n = 104); and education, science disciplines (n = 41). Of these 494 potential journals, 22 were selected as relevant to the study (Table 2). From these 22 journals, 634 potential articles were assessed by reading their title to identify whether they were relevant to the study. Two of the articles were repeats from previous searches and none of the remaining papers were relevant to the study.

Table 2

Journals Included in InCites Journal Citation Hand Search

Journal	Hits	Articles kept
ACM Journal on Computing and Cultural Heritage	0	0
American Educational Research Journal	18	0
British Journal of Educational Technology	33	0
Educational Research Review	18	0
Educational Technology and Society	51	0
Educational Technology Research and Development	41	0
IEEE Transactions on Learning Technologies	45	0
International Journal of Computer-Supported Collaborative Learning	40	0
International Journal of Science and Mathematics Education	36	0
International Journal of Science Education	29	0
International Journal of Technology and Design Education	2	0
Journal of Research in Science Teaching	13	0

Journal of Science Education and Technology	55	0
Journal of the Learning Sciences	21	0
Learning Media and Technology	118	0
Research in Science and Technology Education	12	0
Research in Science Education	32	0
Review of Educational Research	18	0
Science and Education	2	0
Science Education	14	0
Social Science Computer Review	19	0
Studies in Science Education	28	2 repeats
Total	645	0

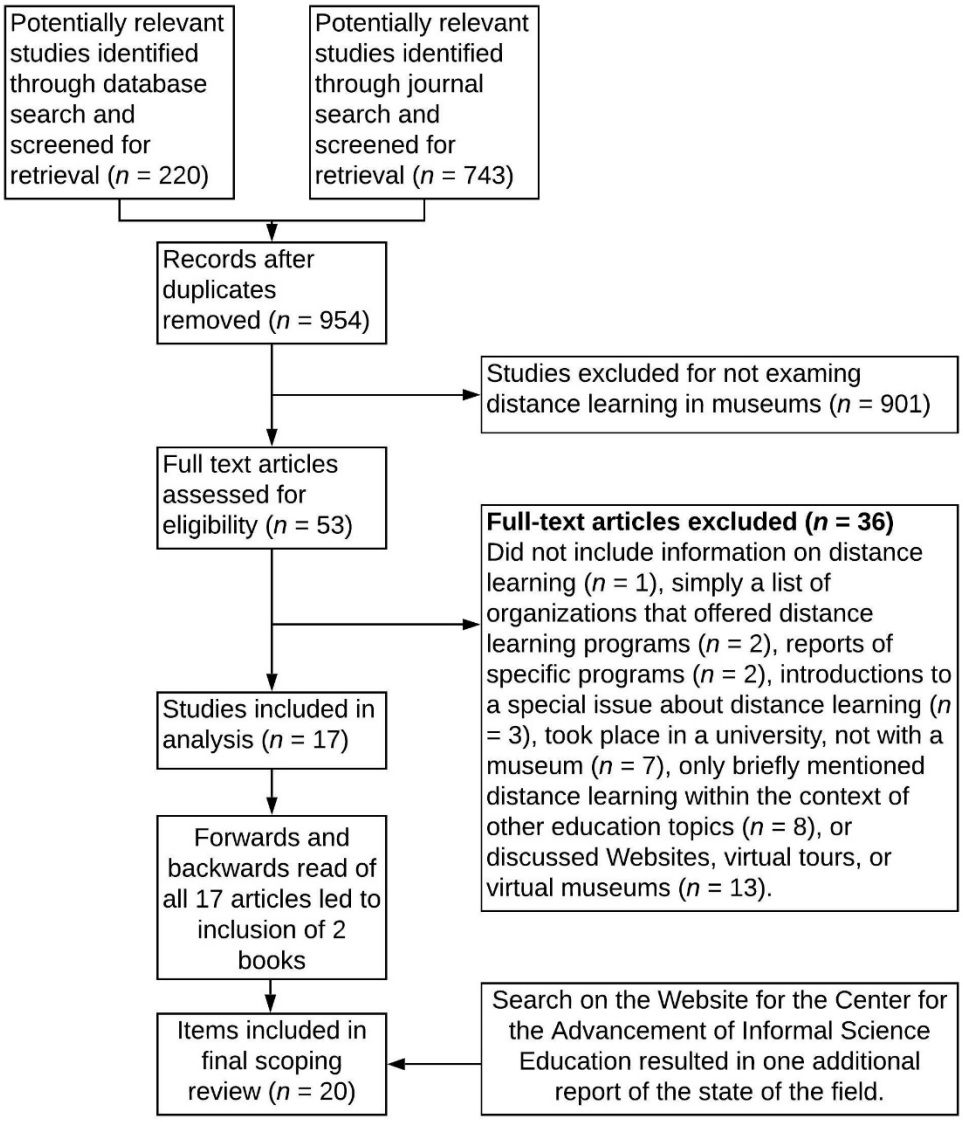
The first author read each of the paper titles as well as the abstracts of any that appeared to fit the study. A total of 53 articles were identified for a full article read based on their abstract. Both authors read all 53 articles and identified 17 articles for inclusion in the study (Table 3). Papers were excluded if they (a) did not include information on distance learning (n = 1); (b) were a list of organizations offering distance learning programs (n = 2); (c) were evaluation reports of a specific program (n = 2); (d) were introductions to a journal issue (n = 3); (e) did not include a museum (n = 7); (f) only briefly mentioned distance learning within the context of other education topics (n = 8); or (g) discussed Websites, virtual tours, or virtual museums (i.e., static, no interaction; n = 13). Figure 1 illustrates the search process based on the PRISMA statement (e.g., Page et al., 2021).

Following the first read for inclusion, a backwards and forwards search for each of the 17 articles was conducted in Google Scholar. This resulted in the identification of two books on distance learning written by Crow and Din (2009, 2011). The books should also be considered by others who want to learn more about a wider range of digital opportunities for museums.

Finally, a search was conducted in the research archives on the Website for the Center for the Advancement of Informal Science Education (CAISE). CAISE aims to advance the field of informal science education through infrastructure, resources, and building connections between stakeholders (CAISE, n.d.). The search for distance learning with research as a limiter identified 13 potential articles. Of these 13 results, only two were related to the subject. One was an evaluation report of teachers' perceptions of museum-based online learning programs and was not included. The other was an examination of the current trends in online learning in museums and was included (Hardee & Duffin, 2015) for a final total of 18 articles.

Figure 1

Article Selection Process



Analysis

Using an inductive approach (Thomas, 2006), the authors individually re-read and coded five of the articles (20.8%) to identify themes. The authors came together to discuss themes and develop a codebook. Once the codes were developed, the authors coded each of the articles. They then discussed each article until they came to a consensus about the codes. This resulted in four major themes found in the literature: benefits to using distance learning in museums, the changing roles of educators related to distance learning, partnerships in developing/implementing distance learning in museums, and barriers to distance learning in museums.

Table 3

Articles Included in Review

Citation	Type of study	Study focus	Methods	Important results	Themes
Barshinger & Ray (1998)	Experimental study*	K–12 school programs	Interpretive study using observations, field notes, pre- and post-interviews, post-visit interviews, researcher reflections	The new technology increased some novelty. It was effective at orienting them to the gallery. Teacher and students all thought the program was successful.	Benefits
Bell et al. (2016)	Case study	K–12 school programs in museums		Discussed the importance of institutional buy-in for university/museum partnerships.	Benefits Partnerships Barriers
Bowen (2017)	How-to			Discussed examples of ways museums use distance learning for conferences and school programs. Listed the technology they used.	Benefits Barriers
Bradford & Rice (1996)	Case study	K–12 school programs		Discussed barriers and benefits. Also claimed the program increased interest in visiting.	Benefits Changing roles Partnerships Barriers
Coquillon & Staples (2015)	Case study*	K–12 students out-of-school		Discussed the development of virtual student summit.	Benefits Partnerships Barriers
Crow & Din (2009)	Case study and guide			Discussed considerations for beginning digital learning opportunities in museums.	Benefits Changing roles Partnerships Barriers
Crow & Din (2010)	Case Study*			Discusses pros, cons, and considerations for developing distance learning programs in museums.	Benefits Changing Roles Partnerships Barriers
Crow & Din, (2011)	Case study and guide			Discussed barriers, challenges, and effective strategies for developing online learning.	Benefits Changing Roles Partnerships Barriers

Din (2015)	Theoretical			Described a range of distance learning programs in museums along with barriers, benefits, and practical considerations.	Benefits Changing Roles Barriers
Engelke (2015)	Case study*	K–12 students out-of-school		Discussed the development and refinement of a distance learning program where participants receive badges.	Benefits Barriers
Gaylord-Opalewski & O'Leary (2019)	Experimental study*	Museum educators	Focus group surveys and interviews	Offered definitions of distance learning along with best practices from those working in the field.	Benefits Changing Roles Barriers
Hardee & Duffin (2015)	Current trends report	Staff and leaders in museum-based distance learning	Interviews	Claimed museum-based distance learning is on a downward trend due to lack of museum capacity and school funding. However, there are many positive opportunities.	Benefits Barriers
Harrell & Kotecki (2015)	Case study	K–12 school programs	Summative evaluation utilizing surveys, interviews, observations, and artifacts	Fostering positive attitudes towards art and emotional connections were best achieved onsite. Knowledge and skills increased through student evaluation of their work. The online platform was not student-centered enough.	Benefits Partnerships Barriers
Hilton et al. (2019)	Experimental study*	Adult learners	Focus group discussions and surveys	When working with adult audiences, success depended on presentation style, content, entertainment value, and technology expertise of participants.	Benefits Partnerships Barriers
Kraybill & Din (2015)	Case study	K–12 school programs		Discussed the development and implementation of online courses in collaboration with a virtual public school.	Benefits Changing Roles Partnerships Barriers
Mazzola (2015)	Case study	Teacher professional development	Formative action research and a survey	Claimed museums should consider developing a MOOC to remain	Benefits Partnerships

				relevant. Shared best practices and lessons learned.	Barriers
Mitchell et al. (2019)	Case study	Museum educators	Self-analysis of the program model	The program did not replace onsite visits, rather it supplemented them. Participants still need interpretation of digital resources as they would on-site.	Benefits Changing Roles Partnerships
O'Leary (2011)	Case study			Discussed the changes in a distance learning program at a museum.	Benefits Changing Roles Barriers
Sanger et al. (2015)	Case study*	Teacher professional development	Written reflections	Discussed the development of sustainable partnerships between museums and schools.	Benefits Partnerships Barriers
Schmidt, (1997)	Case study	K–12 school programs		Discussed the development of an electronic field trip and how to improve on their model.	Benefits Barriers

Note: * Indicates studies with qualitative or quantitative data. For example, some case studies simply described how they designed their programs without any data to support their decision making or argument for a particular strategy.

Results

The manuscripts included in this scoping review are outlined in Table 3. The programs described in these studies predominately focused on K–12 school programs, K–12 students in out-of-school settings, teacher professional development, and adult learners (Table 3). The remaining articles did not discuss specific programs but rather, they evaluated the current state of the field (Hardee & Duffin, 2015) or were broader in scope (Bowen, 2017; Crow & Din, 2009, 2010, 2011; Din, 2015; Gaylord-Opalewski & O'Leary, 2019; O'Leary, 2011). Six studies included either qualitative and/or quantitative data in their results (Table 3). Three articles (Barshinger & Ray, 1998; Crow & Din, 2010; Harrell & Kotecki, 2015) and both books (Crow & Din, 2009, 2011) used constructivism as a theoretical framework to guide their study. In addition to constructivism, Crow and Din (2011) offered a range of alternative theories that might be considered when developing distance learning programs including media theory, cognitive theory, as well as situated and distributed cognition.

Definitions of Distance Learning

Throughout the literature, several different terms were used including virtual field trips (Bradford & Rice, 1996), electronic field trips (Schmidt, 1997), and interactive virtual learning (Gaylord-Opalewski & O'Leary,

2019; Mitchell et al., 2019). To better understand the terms used to describe distance learning programs in museums, Gaylord-Opalewski and O'Leary (2019) interviewed museum professionals who worked with these types of programs. As with other studies, the authors found a wide range of terms for distance learning, which was frequently "interchanged with Interactive Videoconferencing or Virtual Field Trips" (Gaylord-Opalewski & O'Leary, 2019, p. 232). These authors identified eight definitions related to distance learning in museums: (a) synchronous distance learning, (b) asynchronous distance learning, (c) interactive virtual learning, (d) virtual museum educator, (e) interactive virtual learning program, (f) point-to-point connections, (g) multi-point connections, and (h) streaming (Gaylord-Opalewski & O'Leary, 2019). Crow and Din (2009, 2011) also described various types of online learning museums could engage in such as blogs, Websites, and online courses.

Types of Technology

As the articles in this study spanned the period from 1996 to 2019, a wide range of technology was described. One example of early technology was the Integrated Services Digital Network (ISDN) which was popular in the mid-1990s, and which allowed for two-way video conferencing (Bradford & Rice, 1996; Gaylord-Opalewski & O'Leary, 2019; O'Leary, 2011). Two articles discussed the importance of buying specialized computers and webcams (e.g., Bowen, 2017; Bradford & Rice, 1996). Hardee and Duffin (2015) discussed the transition from expensive, specialized equipment towards the use of free technology, but they felt that the free software options were not sufficiently advanced. However, newer articles discussed the ease of using readily available and free or no-cost technology (e.g., Bowen, 2017; Hilton et al., 2019).

Video conferencing was described in 10 articles (Barshinger & Ray, 1998; Bell et al., 2016; Bradford & Rice, 1996; Coquillon & Staples, 2015, Crow & Din, 2010; Engelke, 2015; Hilton et al., 2019; Mitchell et al., 2019; O'Leary, 2011; Sanger et al., 2015). Online courses were described in six articles (Din, 2015; Engelke, 2015; Harrell & Kotecki, 2015; Kraybill & Din, 2015; Mazzola, 2015; Sanger et al., 2015). Two articles discussed the importance of using online chat technology (Coquillon & Staples, 2015; Mitchell et al., 2019). One article discussed use of a flipped classroom model before a museum visit (Harrell & Kotecki, 2015).

How to Develop a Distance Learning Program

In an attempt to help other museums begin new programs, Bowen (2017) wrote an article to help other planetariums through the process of developing "distance learning systems" (p. 86) within their domes. Bowen included the technology and other resources leveraged to develop the new programs. While not specifically a how-to article, Mitchell and colleagues (2019) included guiding questions a museum should ask before developing a distance learning program. The article recommended museums think critically about the resources they already have in place that they can use (e.g., content, experts, tools, educators) and how the technology may change their "institutional practices" (Mitchell et al., 2019, p. 248). Crow and Din (2009, 2011) also offered guiding questions institutions should consider when developing distance learning programs. In all, the books and articles agreed that, while an institution should think critically about its ability to offer distance learning programs, there are many benefits to doing so.

Themes

Benefits of Distance Learning

The most common benefit was that distance learning programs allowed the museums to increase their reach to new audiences as well as increase visitors' access to their collections (Barshinger & Ray, 1998; Bell et al., 2016; Bowen, 2017; Bradford & Rice, 1996; Coquillon & Staples, 2015; Crow & Din, 2009, 2010, 2011; Din, 2015; Engelke, 2015; Gaylord-Opalewski & O'Leary, 2019; Hardee & Duffin, 2015; Hilton et al., 2019; Mazzola, 2015; Mitchell et al., 2019; O'Leary, 2011; Schmidt, 1997). Distance learning programs increased a museum's outreach potential by breaking down geographic boundaries and allowing museums to reach visitors who might not otherwise have access (Gaylord-Opalewski & O'Leary, 2019).

Crow and Din (2010) suggested that online learning offered new ways to connect and communicate with people who might not be familiar with the museum, increasing the possibility for future interactions on a much larger scale. While there has been concern that distance learning programs may decrease audiences' interest in physically visiting, several studies reported the opposite to be true (e.g., Hardee & Duffin, 2015; Hilton et al., 2019; Mitchell et al., 2019; O'Leary, 2011; Schmidt, 1997).

Leveraging distance learning, museums also offered their visitors access to previously underutilized resources (Crow & Din, 2009, 2010; Din, 2015; Engelke, 2015; Hardee & Duffin, 2015; O'Leary, 2011). Through distance learning programs, museums enabled students to examine artifacts up close in ways that would otherwise not be possible (O'Leary, 2011). Additionally, distance learning programs allowed museums to use media and other technological resources that may not be appropriate in the physical museum (Din, 2015).

Several studies also discussed the opportunity to increase engagement with their visitors through distance learning programs (Bell et al., 2016; Bradford & Rice, 1996; Coquillon & Staples, 2015; Crow & Din, 2009, 2011; Din, 2015; Kraybill & Din, 2015; Mazzola, 2015; Sanger et al., 2015; Schmidt, 1997). Bell and colleagues (2016) discussed the opportunities museums have to engage their visitors in authentic science through distance learning programs. Additional studies discussed the ability to use live question and answer sessions to increase engagement with learners (Bradford & Rice, 1996; Coquillon & Staples, 2015). Additionally, distance learning increased engagement through enhanced experiences, increased spontaneity and responsiveness during synchronous programs, and increased reflection and depth of knowledge through asynchronous distance learning experiences (Crow & Din, 2009, 2011; Din, 2015). Distance learning programs also allowed educators to engage with their visitors much longer than with those who attended a one-time program on-site; online materials were much easier to keep current compared to printed materials (Crow & Din, 2009). In addition to engaging with museum educators, some types of distance learning programs offered participants the opportunity to engage with one another and build new connections (Coquillon & Staples, 2015; Crow & Din, 2009; Harrell & Kotecki, 2015). Through distance learning, museums found they were able to inspire their audiences to take action in their communities (Engelke, 2015) and build lifelong interests (Gaylord-Opalewski & O'Leary, 2019).

Implementing distance learning programs allowed museums to increase the types and amount of data they collect about their audiences (Crow & Din, 2009, 2010, 2011; Din, 2015; Gaylord-Opalewski & O'Leary,

2019; Hilton et al., 2019). Distance learning programs offered museums opportunities to gather real-time data about their participants, allowing them to pilot new programs and gain instant feedback to continually improve their programs (Crow & Din, 2010). Education staff were also able to document and archive participants' feedback and responses (Crow & Din, 2010; Din, 2015). Museums also used data for participatory development of programs by allowing participants to have a say in how programs evolved for greater buy-in (Crow & Din, 2009). Furthermore, museums were able to improve their reporting related to the number of people served in educational programs (Gaylord-Opalewski & O'Leary, 2019).

Educators' Changing Roles

Nine manuscripts discussed the changing roles of educators due to the introduction of distance learning programs in museums (Bradford & Rice, 1996; Crow & Din, 2009, 2010, 2011; Din, 2015; Gaylord-Opalewski & O'Leary, 2019; Kraybill & Din, 2015; Mitchell et al., 2019; O'Leary, 2011). The manuscripts in this set spanned 1996 to 2019, leading to a wide range of expected changes related to the implementation of distance learning programs. Early researchers questioned how already busy educators could include these new programs in their programming schedules (Bradford & Rice, 1996). Bradford and Rice (1996) suggested that distance learning programs be offered at odd hours, thus allowing educators to make better use of their time. However, the authors felt that developing these new, time-intensive programs would take away from educator's ability to prepare for onsite programming and that their education staff did not have the necessary training to develop these lessons (Bradford & Rice, 1996). Some authors discussed the importance of having educators specifically trained to facilitate online programs (Gaylord-Opalewski & O'Leary, 2019). However, other authors felt that museum educators were already well-positioned to transition to distance learning due to their experience "creating highly customized and interactive experiences with museum visitors and attending to their interests and needs" (Crow & Din, 2010, p. 162).

Engaging in distance learning "expands the role of the educator" beyond the traditional role of a museum educator (Mitchell et al., 2019, p. 242). Some articles examined how educator roles changed over time (O'Leary, 2011) or changed based on the type of online learning that was implemented (Din, 2015). While educators act as facilitators both during face-to-face and online presentations, the pedagogical strategies used in distance learning programs differ because the forms of interaction have been altered (Crow & Din, 2011).

When thinking about how to support these new types of programs, Kraybill and Din (2015) argued that educators need to start thinking "like entrepreneurs" (p. 172) to monetize their distance learning programs. Crow and Din (2011) described the qualities they believed online educators needed to possess to be effective. This included "creating a climate for learning . . . helping to establish social presence . . . encouraging active participation . . . [and] encouraging others to take leadership roles" (Crow & Din, 2011, p. 76-77). As distance learning becomes more common, educators have opportunities to collaborate with other staff members and negotiate roles and responsibilities in developing educational opportunities online (Crow & Din, 2009, 2010, 2011). In addition to collaborating with their colleagues, museums are taking advantage of partnerships with other organizations to support their distance learning programs.

Partnerships

The theme of partnerships was identified in 12 manuscripts (Bell et al., 2016; Bradford & Rice, 1996; Coquillon & Staples, 2015; Crow & Din, 2009, 2010, 2011; Harrell & Kotecki, 2015; Hilton et al., 2019; Kraybill & Din, 2015; Mazzola, 2015; Mitchell et al., 2019; Sanger et al., 2015). Some of the partnerships identified included (a) partnering with other museums (Coquillon & Staples, 2015); (b) museum-university partnerships (Bell et al., 2016; Mitchell et al., 2019); (c) partnerships with public schools (Harrell & Kotecki, 2015; Kraybill & Din, 2015; Mitchell et al., 2019; Sanger et al., 2015); and (d) partnerships with private companies (Bradford & Rice, 1996; Hilton et al., 2019; Mazzola, 2015). Kraybill and Din (2015) argued that "leveraging of strategic partnerships with public, private, and government organizations, combined with the tools of online learning … will increase a museum's capacity to reach more learners in more meaningful ways than physically visiting the museum could accomplish alone" (p. 172). Additionally, distance learning programs create collaborative teaching and learning environments, which can be mutually beneficial for all partners (Sanger et al., 2015).

Partnerships are beneficial for museums as collaborators may be able to offer access to technological resources or training to use new, and sometimes expensive, technologies (Crow & Din, 2010). Identifying internal and external partners can increase access to a wide range of resources (Crow & Din, 2009). Museums should identify (a) appropriate stakeholders within their museum and other organizations, (b) other individuals who may bring specific strengths and skills, (c) reasons why the collaborators might want to participate, and (d) barriers to collaboration (Crow & Din, 2011). "True collaboration requires a commitment to shared goals, a jointly developed structure and shared responsibilities, mutual authority and accountability for success, along with the sharing of resources, risks, and rewards" (Crow & Din, 2011, p. 55). For example, collaboration with a museum's internal information technology department can support Web design and content creation (Crow & Din, 2010), and working with the development office can lead to funding opportunities (Crow & Din, 2009).

Partnerships with Other Museums. While Crow and Din (2011) briefly describe the utility of partnering with other museums, Coquillon and Staples (2015) shared insight into their experience with museum partnerships. The authors discussed how the Smithsonian's National Museum of American History joined with their affiliate museum partners across the country to host a national student summit. Partner museums hosted regional summits where students could watch the program taking place in Washington D.C., participate in online forums, and engage in local programming. Another partnership included bringing in college students to act as moderators in the discussion forum. This partnership model allowed each museum to have a broader reach and access to resources they would not have otherwise; the partnership reached more than 30 states, several countries, and up to 10,000 viewers each year (Coquillon & Staples, 2015).

Partnerships with Universities. Partnerships between museums and universities allowed both to leverage the resources of the other (Bell et al., 2016). This type of partnership is frequently driven by increased interest in community science (also known as citizen science) and a desire for more university-based public outreach (Bell et al., 2016). Bell and colleagues (2016) discussed a partnership between the Center of Science and Industry (COSI) and The Ohio State University (OSU). Together they developed

> a center where research, science, and university outreach are embedded into the everyday public, student, and family experiences. Guided by formal institutional co-commitments at the highest level, university researchers, faculty, and students engage daily with the 600,000+ on-site guests to COSI and tens of thousands reached through interactive video conferencing. (Bell et al., 2016, p. 300).

Researchers and educators collaborated to design and deliver interactive virtual learning programs based on the research and exhibits taking place at OSU and COSI. This partnership increased the outreach for OSU, enhanced the authentic science taking place at COSI, and resulted in new staff positions shared between the two institutions.

Bell and colleagues (2016) discussed several points of consideration that are essential to the success of this type of partnership. First, there must be institutional buy-in from all levels and multiple points of contact between the two institutions. Decision making must be mutually beneficial. Both institutions must contribute to the investment of the partnership and have a public profile wherein both success and failures are shared between organizations. The personnel selected to engage with the public must be carefully selected from both institutions, and it is essential there are staff to manage administrative duties. Major challenges to this type of partnership included differences in organizational size/structure, institutions operating on different calendars, and leadership changes. Issues associated with leadership changes may be mitigated by a review of the goals and benefits of the partnership (Bell et al., 2016).

University-based museums are also well-positioned to create partnerships across their institution (Michell et al., 2019). When approached by a high school asking for online learning opportunities, the University of Pennsylvania Museum of Archaeology and Anthropology (Penn Museum) collaborated with faculty and graduate students to modify existing programs. The museum educators, faculty, and graduate students collaborated to design a new, multi-component program that leveraged the resources of both the university and museum. This partnership (a) resulted in an association with the high school, (b) created new interdepartmental relationships on campus, (c) addressed the lack of content experts within the museum, (d) increased educators' content knowledge, and (e) led to the use of high-quality pedagogy in the new online programs (Michell et al., 2019).

Partnerships with High Schools. Two articles discussed the benefits of partnerships with virtual high school providers (Harrell & Kotecki, 2015; Kraybill & Din, 2015). Both museums developed online courses to help support students who were required to take virtual classes to graduate. Harrell and Kotecki (2015) discussed the challenges of using an online learning management system to offer semester-long courses. Unfortunately, they found their platform did not meet their pedagogical needs, limiting the amount of self-directed learning that could take place due to a lack of flexibility in the course. Kraybill and Din (2015) partnered with an existing online course provider to increase their capacity through certified teachers working for the provider to teach the course. This strategy allowed the museum to scale up its capacity without straining its resources. The authors acknowledged that not all museums have the resources available to create this type of course in the first place but recommended partnering with outside organizations if interested in developing these kinds of programs (Kraybill & Din, 2015).

Partnerships to Support Teachers. In addition to serving students through online learning, museums support teachers as well. Sanger et al. (2015) discussed a partnership between the New York Institute of Technology and the Albany Institute of History and Art. The partnership received external funding to "increase the capacity of museum educators and teachers to develop successful partnerships and deliver new programs through the use of web-based technologies and share those lessons with the field as a model for future collaborations" (Sanger et al., 2015, p. 148). This article examined the influence of a professional development program where museum educators and formal educators came together to design and implement online programming. In this partnership, the New York Institute of Technology offered technical support while the Albany Institute of History and Art offered pedagogical support. While the partnerships required a large investment of educators' time, both the formal and museum educators gained a better understanding and respect for each other's roles and the challenges they face. The partnerships enabled the educators to learn more about the benefits of engaging in online learning with museums (Sanger et al., 2105).

Partnerships with Private Companies. Some museums have begun exploring online teacher professional development (Mazzola, 2015). Mazzola (2015) discussed the transition from small, online professional development experiences offered by individual museums to a large-scale massive open online course (MOOC) on Coursera. Through their work with Coursera, the museum was able to serve more than 50,000 teachers a year and transition their offerings from individual programs to a model where teachers could participate at any time. The benefits of using an existing platform included better data collection to refine programs, increased outreach and engagement, and encouragement for educators to revise their teaching styles. Online and in-person programs have different pedagogies, so the authors suggested museums should not expect to replicate their in-person programs online. Additionally, the authors recommended museums align their goals between online and in-person programs (Mazzola, 2015).

Beyond partnerships to serve teens and teachers, some museums developed partnerships to serve lifelong learners. Hilton et al. (2019) conducted a focus group study to identify the best way for museums to reach retirement communities. They suggested museums develop partnerships with committees of residents and so allow the audience to help direct the development of distance learning programs for their community. The findings also suggested interactive presentations are best for this audience, though museums need to consider their audio and visual media carefully. Educators should ensure all audio and visual components meet the needs of the senior audience (Hilton et al., 2019).

Early partnerships between museums and private companies came about due to emerging technologies. Bradford and Rice (1996) referenced the development of a partnership between an art museum and a communications company that was interested in researching video conferencing using ISDN. Scientists visited with the education staff to help develop custom software for the museum to use ISDN to videoconference with schools. This collaboration with a communications company helped the museum develop the capacity to videoconference and pilot their new program via a school partnership, and also gave the museum educators the flexibility to experiment and fail forward (Bradford & Rice, 1996). While partnerships bring many benefits, many of the articles reviewed also included barriers that prevent the development of museum-based distance learning programs.

Barriers to Museum-Based Distance Learning Programs

In the literature, technology was the most commonly described barrier (Bowen, 2017; Bradford & Rice, 1996; Coquillon & Staples, 2015; Crow & Din, 2009; Din, 2015; Hardee & Duffin, 2015; Harrell & Kotecki, 2015; Hilton et al., 2019; O'Leary, 2011; Sanger et al., 2015; Schmidt, 1997). For some museums, it was a lack of access to technology in the early days of distance learning (Bowen, 2017; Bradford & Rice, 1996; O'Leary, 2011; Schmidt, 1997). For other museums, the barriers came in the form of technology that did not function properly (Din, 2015; Hilton et al., 2019; O'Leary, 2011; Sanger et al., 2015). Hardee and Duffin (2015) discussed the high cost of maintaining expensive, specialty equipment. Additional museums struggled with systems that did not support the types of pedagogy the educators wanted their audiences to experience (Coquillon & Staples, 2015; Harrell & Kotecki, 2015). Following technology, the biggest barriers described were time, cost, and staffing concerns.

A total of 10 manuscripts outlined how the time needed to develop and implement distance learning programs was a major barrier (Bell et al., 2016; Bradford & Rice, 1996; Crow & Din, 2010, 2011; Engelke, 2015; Hardee & Duffin, 2015; Kraybill & Din, 2105; Mazzola, 2015; Sanger et al., 2015; Schmidt, 1997). Eight articles described the cost of implementing a distance learning program as prohibitive (Bradford & Rice, 1996; Crow & Din, 2010; Engelke, 2015; Gaylord-Opalewski & O'Leary, 2019; Kraybill & Din, 2105; O'Leary, 2011; Sanger et al., 2015; Schmidt, 1997). In addition to being expensive, some authors felt the return on investment for distance learning programs may be too small to justify them (Gaylord-Opalewski & O'Leary, 2019; Hardee & Duffin, 2015). Having insufficient staff to develop and run the programs was also seen as a barrier in nine articles (Bradford & Rice, 1996; Crow & Din, 2010; Gaylord-Opalewski & O'Leary, 2019; Hardee & Duffin, 2015; Hilton et al., 2019; Mazzola, 2015; Mitchell et al., 2019; O'Leary, 2011; Schmidt, 1997). In some cases, staff needed additional training to increase capacity (Crow & Din, 2010; Gaylord-Opalewski & O'Leary, 2019). In others, there was a lack of access to experts who could lead the program (Mitchell et al., 2019). It was even suggested that museums would need to hire a new type of employee who would be better suited to teaching in the online environment (Gaylord-Opalewski & O'Leary, 2019).

Other barriers included a need for dedicated distance learning spaces (Mitchell et al., 2019; O'Leary, 2011), specialized content for the programs (Crow & Din, 2010; Schmidt, 1997), and leadership issues (Bell et al., 2016; Din, 2015; Kraybill & Din, 2015; Mitchell et al., 2019). Din (2015) posited that there must be a "long-term institutional commitment to engage in online teaching and learning" (p. 108) to develop a sustainable distance learning program. Kraybill and Din (2015) suggested that external partnerships may help education staff attain "long-term institutional commitment" (p. 171) from their leadership. However, there are additional barriers when developing distance learning programs that rely on partners, as "lasting relationships must survive leadership changes in continually evolving organizations" (Bell et al., 2016, p. 303).

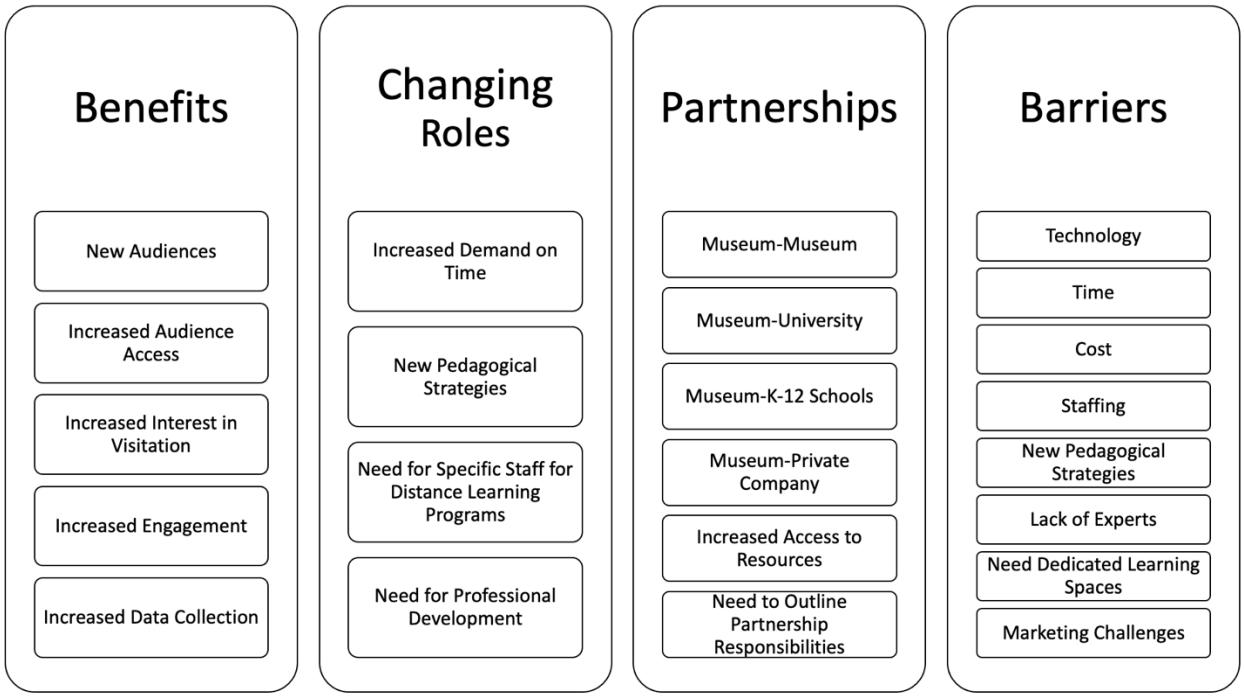
Hardee and Duffin (2015) also discussed barriers due to marketing. They reported that most marketing for museum-based distance learning programs was informal and struggled to reach the appropriate audiences. They also had concerns about the sustainability of the programs. The authors reported a declining trend in museum-based distance learning between 2010 to 2014 due to school budget cuts decreasing demand for

programs, loss of staff due to museum budget cuts, and the cost of maintaining equipment (Hardee & Duffin, 2015).

While the number of museums offering distance learning is increasing (Ennes, 2021), each of the barriers described in this section brings specific challenges; museums must consider them all before choosing to develop new distance learning programs. Figure 2 summarizes the major concepts from each of the themes discussed in this section.

Figure 2

Summary of Themes Identified in the Literature



Discussion and Recommendations

Opportunities to engage learners online continue to increase and museum-based distance learning programs are positioned to contribute significantly (Hardee & Duffin, 2015). In this review, we sought to understand the current state of research on distance learning in museum settings. We found that the literature in this field is relatively nascent and offers a multitude of opportunities for future research.

The types of available technology have changed since these programs began, but technology is still seen as both a benefit and barrier to developing distance learning programs. We found that most museums created programs that focused on online courses and live programming, also referred to as videoconferencing. Other museums tried to leverage new technologies to develop creative new experiences such as a flipped

museum (Harrell & Kotecki, 2015), television programming (Bell et al., 2016; Schmidt, 1997), and using digitized collections (Engelke, 2015).

Many of the articles in this review were case studies that examined individual programs; less than half of the articles offered qualitative or quantitative data. The lack of data in these articles makes it difficult to compare studies. In future, researchers should consider opportunities to collect more quantitative data with larger population sizes in addition to case studies and interviews.

In addition to limited data, many of the studies lacked a theoretical framework; peer-reviewed journals often see this as a failing (Lederman & Lederman, 2015). Only three papers grounded their studies in a theoretical framework (Barshinger & Ray,1998; Crow & Din, 2010; Harrell & Kotecki, 2015), and all three focused on constructivist approaches. Crow and Din (2010) argued that educators in museums have long "advocated a constructivist, learner-centric approach by creating highly customized and interactive experiences with museum visitors and attending to their interests and needs" (p. 162). Additionally, Crow and Din (2011) discussed alternative theoretical frameworks researchers should consider. Identifying appropriate theoretical frameworks for future research on distance learning in museums will be important as the field moves forward.

The overall themes that arose from the literature examined the benefits and barriers of engaging in distance learning, the ways museum educators' roles are changing in response to developing distance learning, and the importance of leveraging partnerships for successful programs. Overwhelmingly, the literature revealed the perception that distance learning programs allowed museums to increase their reach and offer access to learners of all ages and abilities.

Based on the results of this review, museums are clearly aware of the benefits of engaging in distance learning but also face distinct barriers to implementing such programs. The barriers expressed in this study (i.e., technology issues, cost, time, staffing issues, and institutional support) were all identified as barriers in a recent study of current practices in museum-based online learning (Ennes, 2021). The theme of partnerships emerged as a tactic to offset many of the barriers identified in this study. Partnerships allowed museums to reduce costs (Crow & Din, 2010), add to their expertise (Bell et al., 2016), and increase staff capacity (Kraybill & Din, 2015; Mazzola, 2015). The school closures caused by COVID-19 led to an increase in partnerships between schools and museums (Ennes, 2021). As evidenced by the educational offerings offered by museums during closures due to COVID-19, online learning and partnerships will continue to become more important (Butcher, 2020).

While partnerships were seen as a viable avenue for developing and implementing online programs in museums, they involved significant time commitments from all partners (Sanger et al., 2105). Building relationships across organizations improved learning outcomes and outreach strategies, and helped to identify common goals between organizations (Asera et al., 2017). While there is no one best way to build partnerships, effective strategies require support from both institutions' leadership (e.g., Asera et al., 2017; Bell et al., 2016). Specific elements of a partnership that can lead to success include (a) establishing clear goals, (b) defining how the partnership works to support both organizations and their learners, (c) developing a clear understanding of change processes, (d) committing to the long-term relationship building of various stakeholders, and (e) using data to inform decision making (Asera et al., 2017).

In addition to the use of partnerships to overcome barriers, increased professional development will be necessary to support the creation of high-quality online programs as more institutions transition to online learning (Ennes, 2021; Gaylord-Opalewski & O'Leary, 2019). Most museum educators have extensive content knowledge but typically less preparation in pedagogy (Bevan & Xanthoudaki, 2008). As teaching online requires specific pedagogical strategies, professional development should be a major focus for museums offering distance learning programs (Mohr & Shelton, 2017).

Museums have been offering online programs for almost three decades, however, the research in this area is more limited than, for example, studies examining online learning in formal settings. Current research regarding online learning in K–12 and higher education has focused on (a) challenges (e.g., Boelens et al 2017; Rasheed et al., 2020); (b) adult learning theories and online learning (e.g., Arghode et al., 2017): (c) relationships and learning communities (e.g., Emde et al., 2020; Jan et al., 2018); (d) using analytics to improve online learning (e.g., Herodotou et al., 2020; Rajabalee et al., 2019) and (e) the digital divide-particularly during COVID-19 (e.g., Esteban-Navarro et al., 2020; Lai & Widmar, 2020). Recently, there have been calls to develop a field-wide agenda for research in formal online learning (Zawacki-Richter & Anderson, 2014). Current research in online learning for K–12 and higher education has been developing frameworks for best practices and professional development (Adelstein & Barbour, 2017; Mohr & Shelton, 2017) and can act as a guide as the field of museum-based online learning research moves forward.

The museum education research community has the opportunity to collaborate with museum practitioners in the development of a field-wide research agenda and future studies. As evidenced by their biographies, 68% of the authors cited in this review were museum professionals rather than researchers, demonstrating that practitioners are already leading research in this field. "Engaging museum educators in reflecting on their practice and doing research on their own experience in collaboration with researchers seems to have strong potential as a powerful method toward changing practice" (Piqueras & Achiam, 2019, p. 391). Therefore, these research-practitioner collaborations can act as a model for future studies that can lead to highly qualified educators and robust museum-based online learning opportunities.

Limitations

As with any study, this review had limitations. While we tried to be comprehensive, it is possible we missed theses, conference proceedings, or other gray literature that were not accessible through our searches. Our choice of search terms could have been limiting as well if authors chose different terms to describe their programs. Additionally, we limited our search to English which may have excluded some sources of information. However, we feel this review will serve to move the research of distance learning in museums forward.

Future Research

As the research in this field is still emerging, there are abundant opportunities for future studies. Several articles included suggestions for future research questions. Bradford and Rice (1996) recommended that future research examine (a) how widely distance learning can be used, (b) the range of intended audiences, (c) whether distance learning programs can pay for themselves, (d) how many programs can be offered based on limited resources and staff capacity, and (e) whether is it worth the time and resources to develop these programs if they come at the cost of on-site programs. Hardee and Duffin (2015) described the need

for research to examine ways to differentiate online programs, determine the types of online programming museums should be developing, and identify avenues to better market programs to diverse audiences. Harrell and Kotecki (2015) identified the need for additional research on the "significance of blended learning approaches in the field" (p. 129).

We recommend future research aim to move beyond solely evaluative studies and begin to explore fieldwide studies of museum-based distance learning. Future studies should begin to ask larger research questions about the affordances offered by museum-based online learning, appropriate pedagogies for distance learning in museums, and best practices for the development and implementation of these programs.

Conclusion

This scoping review offers a foundational perspective of the current research of distance learning in museums. As museums play an important role in learning (National Research Council, 2009) it is vital we understand how museums are using digital programming to increase their program offerings. In this study, we have detailed the benefits and barriers to developing new programs. We have also discussed the importance of developing partnerships and being cognizant of the changing role of the educators involved in these programs. This review also offers opportunities for researchers to think about the type of work that needs to be done to advance this field.

Researchers in the fields of museum education and distance learning should consider opportunities to support museums as they continue to develop new online programs. This may include exploring alternative pedagogical strategies that are effective for the various types of online programs museums are offering (e.g., MOOCs, programs for adults, virtual tours). Additionally, research on establishing partnerships for museum-based distance learning programming will be beneficial for museums hoping to develop new programming in the future. Specifically, researchers should consider how to establish research-practice partnerships with museums as much of this work is currently being led by museum professionals. However, one of the most vital areas of research will be in developing professional development opportunities to support the educators engaged in museum-based distance learning programs (Ennes, 2021). The opportunity to develop the skills and strategies needed to effectively design and facilitate these programs is necessary to help support museum educators as they design new programs. High-quality professional development will increase the self-efficacy of museum educators and encourage them to design and facilitate online programs that use research-based best practices (Ennes et al., 2020). Since museum-based distance learning programs will continue to grow in importance as the world adapts to COVID-19, establishing a robust research agenda to examine these programs will benefit learners worldwide.

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