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Frameworks and Models for Disseminating Curated Research Outcomes to the Public

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Abstract

In our post-truth society, mobilizing "facts" and "evidence" has never been more important. We live in an age that is paradoxically information rich due to the proliferation of Internet Communication Technologies (ICTs) and information poor due to the spread of misinformation. Academic research outcomes are traditionally disseminated via peer-reviewed publications, conference presentations, and in the classroom; however, this research is not often effectively communicated to both decision makers and the general public(s). There is no perfect way of disseminating research outcomes; however, there are lessons to be learned from curatorial and communication frameworks developed in museums as these institutions have a long history educating and engaging the public. This article explores the new concept of "research curation," or rather the enhanced dissemination of curated research outcomes to reach diverse audiences. Closing the "gap" between academia and the public is essential for increasing civic literacy around issues that threaten sustainability. By adapting curatorial and communication methods developed in museums along with ICT models, the practice of "research curation" can be an effective framework for improved dissemination of academic knowledge.

Keywords

research curation, content curation, social media, research dissemination, museums, online engagement, frameworks

Introduction

Never before has communicating the "facts" or "evidence" been more important as witnessed by the recent mobilization of misinformation in the current political landscape of the United Kingdom and the United States. We live in an age that is paradoxically information rich due to the proliferation of Internet Communication Technologies and information poor as a result of the emergent "post-truth" society. In this age, academic outreach is at an all-time low and complicated by changing mercurial social media platforms. Academic research outcomes are traditionally disseminated via peer-reviewed publications, conference presentations, and in the classroom. The publication of individual academic titles is now based on print sales per title of 200 or fewer; in the United Kingdom, average sales per title fell from 100 to 60 (Reisz, 2017). The failure of climate science until recently to hit the political agendas of the developed world is evidence of a major gap in disseminating research results to both decision makers and the general public(s).

As rapid environmental, social, economic, and political changes occur, demand for concrete data and accurate information has considerably increased (Walker, 1998). The collection and analysis of data "on economic, social, and political processes" has therefore become "crucial to the functions of government" and for the activities of private enterprises, researchers (Walker, 1998, p. 1), and the public. Limited access, as well as inadequate data sharing and dissemination practices, can carry social costs (Walker, 1998), especially when it comes to decision making and developing evidence-based policy. In the absence of open and integrated transdisciplinary information systems (Walker, 1998), libraries and archives fill part of this void in their roles as physical and digital repositories for vital data and information. Their labeling and classification standards are effective for audiences who have access to their services (i.e., databases, stacks, physical repositories, etc.); however, they do not go far enough. A key principle in the practice of information dissemination is understanding your audience and their needs, and to disseminate information accordingly. In diving

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deeper into the GLAM (Galleries, Libraries, Archives, and Museums) sector where access to information is at the center of their activities, the focus of audience engagement in museums is of particular interest when disseminating academic research outcomes.

The rise of social media has also transformed the way society accesses and disseminates information. As social media sites became communication beacons for many to quickly express their thoughts, share accomplishments, and circulate news, a thirst for information was ignited. As a result, those in academia have engaged in debate on the merits of using social media to disseminate their research outcomes, subsequently sparking divisive ideas. While one anonymous PhD student laments in a *Guardian* article that many academics waste taxpayer dollars by using social media to prove their enthusiasm and dedication to the profession (Academics Anonymous, 2016), Willingham (2016), a scientist and writer, argues that social media allows researchers to give access to their data to the very people who fund their work. She also points out that Twitter breaks down geographical, disciplinary, and cultural barriers while providing a platform for "idea exchange, troubleshooting, problem-solving" (para. 23). Blewett (2016), a senior lecturer in education and technology at the University of KwaZulu-Nata, argues that writing for social media significantly reduces the publication time lag, as research outcomes can be shared within hours or days. He also candidly states that "change isn't coming to academia—it's here" (para. 15), which is why he urges academics to embrace new ways of writing and sharing research outcomes to maintain relevance.

Although social media appears increasingly more vital for scholarly communications, academics who have already embraced online tools to disseminate their research outcomes are met with considerable challenges. The abundance of users on Twitter and Facebook (Davis, 2017), for example, makes it difficult to connect with like-minded users, reach new audiences, and navigate the mass of information available online. Another challenge is boiling down complex concepts and scientific research into 280 compelling, yet accurate characters via tweets or recounting research results in blog posts of 500 words or less.

In this article, we explore a concept that the second author (Dale) began experimenting with a few years ago called "research curation," or rather the wider dissemination of research outcomes or the practice of communicating a curated body of work. This practice integrates contemporary curatorial and communications methods developed in museums with Internet Communication Technology best practices to strategically disseminate curated research outcomes to diverse audiences not typically reached through standard academic communication channels. This practice also establishes a framework for reformatting academic research outcomes into more accessible mediums (videos, art, data visualizations, etc.) using a wide variety of online channels for the more timely transfer of knowledge. We begin by outlining a brief history of the museum and unpack the term "curation." We subsequently introduce the museum practice of "interpretive planning" and exhibit label writing along with the three following museum-based frameworks: "Ideas, Objects, People"; "Skim, Swim, Dive"; and "Digital Engagement Framework" (DEF). We then outline our social media channels and dissemination projects, explore how the three frameworks can be integrated into the practice of research curation, and finally how research outcomes can be reformatted for online dissemination. The article concludes with an examination of what we mean by the term "research curation."

A Brief History of the Museum

Museums have a long history of educating and engaging the public. They have developed effective best practices centered on audience and visitor engagement which inform their curatorial, communications, and public programming methodologies. However, these institutions have not always been vibrant cultural hubs that engage with and reflect contemporary society. The Wunderkammer, better known as a Cabinet of Curiosities, is often considered the origin of the modern museum in the Western world where practices of curation or the categorization of objects took place. The first pictorial recordings of these cabinets or art collections are from the 16th century. As microcosms or theaters of the world, these often private collections housed natural specimens, archeological artifacts, geological samples, antiquities, religious or cultural relics, and art. Curators of these cabinets displayed their tastes in aesthetics, their knowledge of science, as well as their general interests in the obscure or novel. They also asserted their socioeconomic status as many cabinets belonged to "royalty, aristocrats and wealthy merchants" (Balzer, 2014, p. 34).

The public museum in the Western world, as we know it today, took shape during the late 18th and early 19th centuries. According to sociologist and cultural studies academic Bennett (1995) it came into being alongside other social developments where governing bodies identified the potential for culture to act as a vehicle to exercise "new forms of power" (p. 19). As the "habits, morals, manners and beliefs of the subordinate classes" (Bennett, 1995, p. 19) were considered the mechanisms of culture, it was an ideal target for regulation and transformation. Only in the mid-19th century, however, did governing bodies enlist institutions of "high culture," such as public museums, to help civilize and reform society (Bennett, 1995). By invoking the influence of "high culture" inherent in early museums, they believed they could transform the private life and behavior of society. Museums ultimately functioned as spaces for "observation and regulation" (Bennett, 1995, p. 24) where working class visitors could learn, emulate, and subsequently assume the standards for public conduct.

As museums preserved cultural memory, they belonged in the "realm of secular knowledge" (Duncan, 1995a, p. 8) and existed as separate entities from the ritualistic realms of the monarch and church. As a result, the upper classes were tasked at assigning art and artifacts with value and meaning (Bennett, 1995) because curated displays addressed scientific and humanistic disciplines (Duncan, 1995b). Museum collections were assigned authoritarian value as social progress was often linked to the "materiality" of objects (Witcomb, 2003). This set the curatorial tone for years to come as museums typically asserted their power over the collections they displayed and the knowledge they transferred.

In 2009, the National Endowment for the Arts (NEA) released a report on the 2008 state of arts attendance in the United States. This alarming report revealed that art museum visitorship had slipped to its lowest rate since 1982 (NEA, 2009). With a decline in museum attendance toward the end of the 20th century, museums in the United States (and internationally) began reshaping their practices. This paradigmatic shift gradual took place during the 1980s, 1990s, and 2000s, and transformed the focus of curatorial programs and engagement practices. Artifacts and the voice of the curator were no longer the sole emphasis of these cultural institutions, according to museum scholar Hooper-Greenhill (1992). In the modern museum, visitors shifted from passive learners to active participants who seek knowledge (Hooper-Greenhill, 1992). This demand for information transformed curatorial processes, making them more open, collaborative, and mindful of visitor experience (Hooper-Greenhill, 1992). According to Andrea Witcomb (2007), this "New Museology" was a movement in which contemporary museums "challenge[d] dominant views of the museum as a site of power relations" (p. 133). By situating the community at the "heart of the museum enterprise" (Witcomb, 2007, p. 133), she argues that it gave voice and agency to audiences and positioned the curator in the role of the facilitator rather than the "figure of authority" (p. 133). Nina Simon (2010), author of the highly influential text, "The Participatory Museum," describes this process as shifting audiences from passive consumers to cultural participants (p. ii).

Museums continued to evolve as they embraced digital technologies to maintain cultural relevance, to expand their audiences, and to meet the "information needs of society" (MacDonald & Alsford, 1991, p. 305). They subsequently adapted methods from other fields—namely marketing, communications, and web development—and combined them with their existing practices to establish a benchmark for online communication activities. Museums and academia have many things in common, namely their focus on education and research as well as some of their funding sources. The paradigmatic shift in museums can serve as a lesson for why academics should adapt and evolve their dissemination practices, in meeting the increasing demand and democratization of information in the 21st century. Such practices will further maintain the value and relevance of academic research within society, especially given the polarized and politicized debate around subjects such as climate science.

Curate, Curator, and Curation

The words "curate" and "curator" have held many meanings over the centuries and continue to evolve. According to British art show curator Morton, the term "curatores" originated in Ancient Rome and referenced "senior civil servants in charge of various departments of public works" (2011, para. 1). During the late medieval period, circa 1340, "curate" signified a spiritual pastor who was entrusted with the cure of souls ("Curate, n," n.d.). In 1667, the role of the "curator" was referenced in the *Philosophical Transactions of the Royal Society* (1665-1752, Vols. 1-46; "Curator," n.d.). By the 18th and 19th centuries, the act of curating was reserved for the learned, the elite, and the wealthy who held intellectual power over the "studious and curious" visitors of museums (Blight, 2013, para. 1). In 1870, "curated" was referenced by American-born British writer, Henry James, when describing the staging or display of a quaint historic manor house, marking a potential shift in its meaning ("Curate, v", n.d.). By the late 20th century, to "curate" signified a range of tasks associated with exhibition making in and outside museums (Morton, 2011, para. 2). In the 21st century, the curator's "competence is relocated from a direct relation with selection and display to an ability to generate narratives and direct a sequence of experiences," according to Francesco Manacorda (2003, p. 11). The subject of the exhibition, or its "raison d'être," as described by Lynne Cooke (2006), is ultimately brought to life by the curator. Exhibition-making in the 21st century therefore "theorizes issues deemed central in contemporary cultural debate" and are "transmitted via various channels" (Cooke, 2006).

Over the last 10 years, the term "curation" has taken on a whole new meaning. The term "curate" is used fluidly, depending on the context. With the act of curation suddenly appearing in popular vernacular, it has been applied to any activity around culture related to sourcing, arranging, editing, or filtering (Fotopoulou & Couldry, 2014). iTunes was one of the first online platforms to adopt it outside of the museum context, as they used it to describe special playlists. Balzer (2014) points out that retail items are often subject to curated experiences through selection and organization, "constituting an amplification of their value, along with that of the brand presenting them" (p. 96). Early bloggers quickly caught on to the curatorial buzz and featured carefully crafted and categorized content, before Web 2.0 tools and social media platforms such as Facebook, Twitter, and Instagram became commonplace. Before long everything from music festivals to menu items was "curated." While it is not entirely clear how "curating" became a buzz word in pop culture, it has undoubtedly taken on a whole new meaning. Essentially, "it goes back to the basic notion of identity: who we are

expressed by what we like and collect" (p. 132), according to Balzer (2014).

With the advent of Web 2.0 tools, it is easy for anyone to engage in the act of curation. One of the original think pieces criticizing the democratization of the term was written by former art curator turned blogger Sicha (2012) who suggests that bloggers are essentially "choosing among things that are created" (para. 1) by others. He argues that without the artist or the creator, curating has nothing. Sicha also suggests that artists began to realize that they had different ideas from curators and were worried about the representation of their works. Popova, the founder of Brain Pickings and a self-described "curator of interestingness," is one of the original online content curators. Exploring "all things curious and inspiring" (Sweeney, 2012, para. 2), her website illuminates moments in art, history, and culture found in offline sources. In countering the "if it's not Google-able, it doesn't exist" (Sweeney, 2012, para. 2) mind-set, Popova uses her web platform to curate a space celebrating obscure yet timely knowledge.

Lessons From Contemporary Museum Frameworks and Social Media

Interpretive Planning and Exhibit Label Writing

A key step in developing museum exhibits and educational programs, applicable to the online dissemination of research outcomes, is interpretive planning. Originally conceived by Freeman Tilden and used by the National Park Service (2016) in the United States, interpretive planning helped informal learning sites effectively interpret and communicate historical and scientific information to a diversity of park visitors. As there is no standard framework for interpretive planning, definitions of this practice vary. In *Interpretive Planning for Museums: Integrating Visitor Perspectives in Decision Making*, the authors define it as "a deliberate and systematic process for thinking about, deciding on, and recording in a written format or plan educational and interpretive initiatives for the purpose of facilitating meaningful and effective experiences for visitors, learning institutions, and communities" (Wells, Butler, & Koke, 2013, p. 36).

For museum exhibits, interpretive plans are established early in the process since they function as curatorial roadmaps that set the tone and voice of displays. They unify museum departments and staff who collaboratively develop exhibits in the creative presentation (Wells et al., 2013) of information to engage visitors and stimulate thinking. In connecting the various elements of an interpretive program, they include the "big idea" or thesis, the narratives, as well as the core themes and subthemes of an exhibit. They also strategize how information will be presented through a variety of mediums—including artifacts, labels, digital interactive elements (iPads, touch screens, augmented reality, etc.), and even audio tours. Effective interpretive plans ultimately embody museum missions, visions, and mandates, along with educational practices, audience engagement strategies, and marketing plans.

An important step in exhibit development is label writing. The seminal work on museum exhibition label writing, *Exhibit Labels: An Interpretive Approach*, was authored by Beverly Serrell (1996), and despite major advances in digital technology over the last 20 years, much of the concepts, practices, and ideas outlined in this publication are still highly relevant. In the introductory chapter, Serrell (1996) argues that museums must "work harder to write labels for visitors, not for ourselves" (p. xii). Her series of techniques not only help visitors better understand information in exhibits, but also help them find personal meaning thereby increasing their level of engagement. She also explores how effective label writing is guided by a clear purpose, how it considers different learning styles and reading levels, and how it presents information through varying formats (Serrell, 1996). When strategically crafting interpretive labels, museums can engage broader audiences and tell a more compelling and engaging story. As Neil Postman wrote in the book's foreword, Serrell (1996) demonstrates how carefully crafted labels have the power to communicate "texture and resonance to awaken us fully to what is in our presence" (p. vii).

Ideas, Objects, People Framework

Reformatting research outcomes using different media types is an effective method for public engagement and knowledge mobilization. It not only helps circulate research findings and outcomes beyond academic journal articles and conference presentations but also strategically uses visual messaging to engage diverse audiences and age cohorts. While museums inherently present information visually through the materiality of their collections, many include content programs filled with videos, audio clips, mobile applications, virtual reality, and even gaming apps, which not only enhance exhibit label content but also provide additional points of entry for visitors.

The *Ideas, Objects, People* visitor typology developed by the Smithsonian Institute based on visitor studies is a curatorial framework that is adaptable for dissemination practices to mobilize academic research outcomes online. The highly influential report, "Ideas, Objects, or People? A Smithsonian Exhibition Team Views Visitors Anew" (Pekarik & Mogel, 2010), introduced a new visitor typology emphasizing the need to curate more audience-centered exhibitions as the prior experiences and personal dispositions of visitors often determines the impact of exhibitions. They argue that offering multiple points of entry whether through historic or scientific information (for visitors who like to read about facts), material objects (for visitors who enjoy observing artifacts), or stories of people (for visitors who want to learn about society or the human element) is key to engagement (Pekarik & Mogel, 2010).

During a series of in-gallery studies, researchers observed which elements visitors gravitated toward in exhibits and their reactions. They noted that "personal orientations drive both attraction and response" and that "visitors are likely to find only what they are looking for or are sensitive to" (Pekarik & Mogel, 2010, p. 472). The researchers developed their findings into the IPO-AEF acronym (Idea-People-Object: Attract, Engage, and Flip). They proposed that exhibit-makers should deliberately design displays that "appeal to one of the three preferences: Idea, Object, or People" (Pekarik & Mogel, 2010, p. 473). Once visitors are attracted and engaged, exhibits should then "flip" them to an "unexpected experience" that engages them with another element that is object- or people-based.

Skim, Swim, Dive Engagement Framework

In academic circles, there is concern that oversimplifying complex ideas, facts, and findings to fit brief online descriptions or 280 character tweets is problematic or even misleading. Ernesto Priego, a lecturer at the City University of London, though in favor of using social media in academia, stated in a 2013 *Guardian* article that the previous "140-character limit of tweets encourages direct, generalising, simplistic statements" (para. 7). Tim Caulfield, a researcher at the University of Alberta, coined the term "scienceploitation" referring to instances when the media inaccurately simplifies "a legitimate area of science" (Groshek & Bronda, 2016, para. 7) for the public or for the sake of "click bait." While tweets are essentially "fragmentary glimpses," as Priego (2013, para. 13) calls them, they can function as beacons for a larger network of curated content centered on user engagement. As museums create extensive gateways for curated web content, the sector has developed an innovative approach to digital engagement appropriate for academic research mobilization.

Engagement with online museum resources, including digital exhibitions and social media, is often approached through the *Skim, Swim, Dive* framework, a methodology conceived by Charlotte Sexton, the former Digital Media head at *The National Gallery* in London. First presented at the 2012 *MuseumNext Conference*, it is a framework that gives museum visitors, both in-person and online, the opportunity to explore various forms of content tailored to three levels of engagement. Blasco (2016), a museum educator and social media manager at the National Museum of American History, described this curatorial framework as "engaging visitors at different depths of content" via Twitter during the *American Association of Museums Conference* in 2016. The architectural features of websites following this strategy enable visitors to choose their own adventure, so to speak, as varying depths of information are at their fingertips: they can skim the surface of online content by viewing interpreted digital exhibitions filled with images, videos, and brief descriptions as well as social media posts; or seek additional context and explore facts, blogs, and exhibit catalogs; or seek in-depth analyses, and peer-reviewed research through hyperlinks to articles, reports, research notes, archival material, and presentations. Users can also move back and forth between the content levels.

When the *National Gallery of Art* (2014) in Washington, D.C., launched *Digital Editions*, an initiative to present scholarly content online, they referenced the *Skim, Swim, Dive* framework as a way for "art lovers from all over the world" to explore "rich areas of [their] permanent collection" (para. 2). Their goal was to create an online environment, fully integrated with their website, that provided open public access to the gallery's permanent collections and exhibit catalogs. With enhanced tools for reading, searching, citing, and note-taking, *Digital Editions*, mobilized digital surrogates of archival and library materials through a "dynamic research experience" (National Gallery of Art, 2014, para. 11). This expanded the audience outreach to not only in-person visitors but to online visitors as well. By using the curatorial framework of *Skim, Swim, Dive* to share research outcomes online, the *National Gallery of Art* revealed how this method could be integrated into digital engagement strategies for mobilizing academic research online.

The Digital Engagement Framework

The *Digital Engagement Framework (DEF)*, created by Jasper Visser and Jim Richardson (2013), is a tool "to help organizations structure their thinking around digital engagement" (Visser, 2015, para. 1). It helps organizations identify "value creation opportunities" and develop "strategies, processes and technologies to structurally engage your audience to maximize your co-created value" (DEF, 2015, para. 1). The DEF adopts the business strategy of "value creation," which is often associated with finances; however, in this context, it also applies to creating value in the content that is shared online for target audiences. Digital media can effect change from the bottom up and even break down hierarchal barriers; however, an effective strategy requires support from the top (Visser & Richardson, 2013). Collaboration and cooperation is essential between decision makers, managers, and those who carry out the hands-on work.

Although the DEF is structured around large institutions and organizations with many stakeholders, key elements can be applied to smaller operations. In *Digital Engagement in Culture, Heritage and the Arts* (2013), Visser and Richardson explore how digital media can be used in a more effective way. They also provide key details on how to use the DEF and how to customize the framework. They first argue that framework users must "have a convincing story" (Visser & Richardson, 2013, p. 3), referred to as a "strategy." In doing so, users will better understand what they can achieve and how to get there.

The framework is broken down into four main components: the organization, assets and audiences, engagement

strategies, and technologies and processes. Through a series of questions visually presented in building blocks, users can lay out their objectives, vision, trends, metrics, reach, assets, digital channels, and audiences to have a better understanding of what they offer in terms of engagement. While Visser and Richardson (2013) assert that the DEF simplifies reality and that implementing successful digital engagement strategies can be complex, what the framework offers is a visual platform that can help bridge the divide between "the simple framework and the complicated reality" (p. 3). A key lesson from this framework is that planning your digital strategy is as important as the quality of the content you are producing.

CRC Research Dissemination, 2001 to 2019

Over the last 18 years, the Canada Research Connections program (CRC Research) has experimented with the use of various Internet communication tools and techniques to explore how to reach diverse public(s). CRC Research began experimenting more proactively with social media in late 2010 to determine best practices for disseminating scientific concepts and research to large, diverse, public audiences (Newell & Dale, 2015). The concept of dissemination draws on communication processes, not dissimilar from a television, where a message is transmitted by a sender through an indirect one-way path to a receiver, as suggested by Hooper-Greenhill (1994). In her seminal book, *Museums and Their Visitors*, she describes communication as a process that aims "to produce an effect on another person" (Hooper-Greenhill, 1994, p. 37). If this intention is absent, she explains, the process is "expressive rather than communicative" (Hooper-Greenhill, 1994, p. 30). While there is no way for the receiver to respond through traditional academic channels, online communication tools, such as social media, offer a more active method for users to engage with academic research outcomes.

Social Media

CRC Research shares a variety of content types—including peer-reviewed journal articles, reports, blog posts, news items, data visualizations, videos, music, and artworks—across our social media networks. This includes Facebook (https://www.facebook.com/CommunityResearchConnections), Twitter (https://twitter.com/crc_research), Instagram (https://www.instagram.com/sustainability_stories/), YouTube (https://www.youtube.com/user/crcresearchRRU), Pinterest (https://www.pinterest.ca/CRCResearch/), and our blog, *Views From the Edge* (https://crcresearch.org/crc-blog/archive). We not only share our research outcomes on these platforms but we also actively comb trusted sources to identify additional "curated content" to increase the density and centrality of our research dissemination. In following best social media practices, we share relevant blog posts, peer-reviewed academic journals, and reformatted research outcomes generated by other academics, research labs, and organizations working in the field of sustainable community development. This helps establish connections with other social media users and simultaneously helps us maintain a constant stream of content shared to the platforms. This practice also enriches our social media metrics by illuminating successful and unsuccessful social media strategies and practices. As suggested by Cairns and Birchall (2013), "the curator of the digital world is positioned as both mediator and tastemaker, using content created elsewhere as raw material for the making of meaning" (p. 4).

Website

CRC Research hosts a rich research website (https://crcresearch.org/) that reaches over 95% of the world's countries and had a total of 57,762 users from April 2017 to March 2018. It contains case study libraries (https://crcresearch.org/community-research-connections); data visualizations (https://crcresearch.org/visualizations/); the CRC Research blog, *Views from the Edge* (https://www.crcresearch.org/crc-blog/archive); research project archives (https://www.crcresearch.org/social-capital-and-agency) along with publications listings (https://www.crcresearch.org/publications/articles).

e-Dialogues

Our original e-Dialogue platform, developed in 2001 by the second author (Dale), was created to engage diverse groups of people in substantive online dialogue from different sectors on subjects related to sustainability (Dale, 2005). Not only were the e-Dialogues designed to enhance literacy on a variety of subjects, but they were also hosted to help influence the public policy community (Dale, 2005). To date, the second author has hosted over 80 e-Dialogues using a virtual, real-time text-based forum. The system was subsequently redesigned and relocated to Changing the Conversation (https://www.changingtheconversation.ca/) in 2014.

Edging Forward Exhibit

CRC Research collaborated with Canadian artist, Nancyanne Cowell, on an exhibit titled *Edging Forward: Reconciliation, Reconnection and Regeneration*. Hosted at the Robert Bateman Centre in late 2017 and the Royal Roads University Library Showcase in early 2018, this experiment in disseminating curated research outcomes centered on *Edging Forward: Achieving Sustainable Community Development* (Dale, 2018), which detailed 15 years of research on sustainable community development. The exhibit featured literary interpretations from the book, nine oil mixed-media paintings, and a rich online resource library displayed on iPads. During the run of the exhibit, the Robert Bateman Centre received 1,653 visitors and 144 visitors at the opening.

Curating Research Outcomes for Dissemination

The practice of curating research outcomes is not museum curation. However, it adopts information dissemination practices pioneered in museums and adapts them to mobilize academic research outcomes online. It also specifically draws on the techniques, strategies, and best practices from interpretive planning along with the three frameworks discussed earlier—*Skim, Swim, Dive; Ideas, Objects, People*; and *DEF*. Museum-based digital managers Cairns and Birchall (2013) suggest that "museums act as filters for cultural abundance" (p. 4). Objects on display in exhibits are subject to a curatorial filter as a result of the volume of museum collections versus space limitations for dissemination. Strategically grouped together through a curatorial framework, exhibits exist as microcosms of the world. Thus, curatorial interventions provide critical interpretation, add meaning, and select relevant facts to enhance engagement and more critically, enhance understanding. The same concepts are applicable to the practice of disseminating curated research outcomes online.

Ideas, Objects, People Framework Application

In applying the *Ideas, Objects, People* framework to curating research outcomes online, whether on research websites or across social media networks, a key takeaway is the importance of considering the interests of your audience when developing dissemination strategies. For optimal engagement, consider making research outcomes available in multiple formats to appeal to the three types of users: ideas-based, objects-based, and people-based. For example, peer-reviewed articles and research reports could appeal to ideas-based users. Video- or audio-based interviews (if publishable), human-centered stories (blog posts, videos, audio recordings), and researcher profiles (as a few examples) could appeal to people-based users. Research outcomes reformatted (curated) into artworks, images, videos, data visualizations, maps, and music could appeal to objects-based users, and may even affect them on a visceral level. As suggested by Newell, Dale, and Winters (2016), data visualizations have "a communicative advantage over text-based media in the way that they can convey a message using multiple senses, engage people on an emotional level and provide a degree of salience to the information presented" (p. 3).

We integrated elements of the *Ideas, Objects, People* framework to the *Edging Forward: Reconciliation, Reconnection and Regeneration* exhibit. The main curatorial goals for *Edging Forward* was to bridge art with science and to offer multiple points of entry for visitors by creating a multisensorial media experience. This ensured that we established cohesion between the three forms of media—literary interpretations, paintings, and the resource library. Displaying the book passages tapped into the "ideas" element as they explored concepts, theories, and research around sustainable community development. Certain literary interpretations flipped from the "ideas" element to the "people" element, intended to engage visitors on a visceral level, as they shared personal stories and experiences from the perspective of the second author (Dale). The largescale paintings—with their luminosity, vibrancy, and texture—fulfilled the "objects" element as they were material in form. The online resource library, displayed on iPads, extended the experience of the exhibit and encouraged visitors to dive deeper. It also digitally replicated the three forms of media displayed in the physical exhibit (literary interpretations, paintings, and the resource library) thereby extending the *Ideas, Objects, People* framework to the online realm. It also enabled visitors to engage digitally with the project beyond the gallery walls by giving them user-control over the content presented, encouraging them to flip between the three user types from the IOP framework.

During the month-long run of the exhibit, the iPads in the Robert Bateman Center received 804 pageviews in the gallery. Another device used to extend the exhibit and to reach digital visitors was an online exhibit catalog. In less than 3 weeks, it received 202 reads and 581 impressions. Using statistics gathered on Google Analytics and through our social media channels CRC Research, 2017a), we measured growth across our online platforms from April 1, 2016, to March 31, 2017. Through strategic content scheduling by the first author (Clifton-Ross), engagement on Twitter rose by 1133% from the previous year, while impressions increased by 877%. Our Facebook page reached 10,386 users, an increase of 392%. Readership on our blog increased by 115% as a result of a 72% growth in weekly posts. Our main research website, crcresearch.org, received 65,000 users, an increase of 11% over the last year, and received 206,026 pageviews, an increase of 87% (CRC Research, 2017a).

Skim, Swim, Dive Engagement Framework Application

CRC Research integrates the *Skim, Swim, Dive* framework into our practice by developing content programs featured across our research websites. To help promote and disseminate useful knowledge generated through our e-Dialogue program, as an example, we developed a strategic approach for disseminating the research outcomes from these virtual conversations. From September 2017 to April 2018, we hosted four virtual real-time conversations in partnership with *Women for Nature*, a *Nature Canada* initiative. We convened researchers, practitioners, and civil society leaders to identify and discuss solutions for biodiversity conservation in Canada. Our goal was to increase civic awareness, engagement, and literacy on the importance of biodiversity conservation.

We began by developing a webpage promoting the series, which included a high-level description highlighting the themes, questions, and goals that would be addressed during the four individual conversations. This main webpage enabled users to *skim* the surface of the topic as we referenced recent developments in biodiversity loss and shared key information such as dates and connections details. The written information, design, and images that shaped the webpage provided enough details for users to simply "skim" the surface or learn the essentials—the "what," "why," "where," and "how." If users then wished to "swim" through the webpage, they could click on a link to the World Wide Fund For Nature's "Living Planet Report 2016" and learn about why 67% of wild animals will disappear by 2020—the very publication that instigated the conversation series in the first place. To "swim" deeper, users could also click on hyperlinks for each of the four conversations, which included the following details: (a) a general description of the conversation, including ideas, questions, and goals; (b) panelist biographies, headshots, and links to their respective organizations; (c) the date and time of the conversation; and (d) direct links to the e-Dialogue forum and instructions on how to join.

Once users passed through the two previous stages of content engagement, they could then "dive" into the conversation series in a few ways. First, they could join the conversations in real-time as audience members where they could silently view the forum or actively engage in the audience discussion section. Second, they could download a formatted copy of the conversation transcript. This document was made available on the general webpage promoting the conversation series. If users wanted to "dive" even deeper they could visit the Biodiversity Resource Library (https://www.changingtheconversation.ca/biodiversity-library), which provided links to a variety of seminal articles (academic and nonacademic), reports, and atlases on biodiversity along with videos, art projects, and a biodiversity-themed Pinterest board. Many of the resources included in this rich library were shared by the panelists during the conversations. The ultimate research outcome developed from this project is a biodiversity action agenda listing a series of policy recommendations for Canadian decision-makers that was published in February 2019. It is available as a downloadable PDF in both English and French as well as a webpage (https://www.changingtheconversation.ca/biodiversity-action-agenda), bringing users back to the "swim" stage of engagement. A key characteristic shaping the "Skim, Swim, Dive" framework is that content from all levels of depth are available at the users' fingertips. While it is up to the user to make the transition, whether by swimming or diving, the ways in which the content is curated is a key influencing factor on the user's level of engagement.

The Digitial Engagement Framework Application

Since planning your digital strategy is as important as creating valuable content, the first author (Clifton-Ross) followed key lessons from the *DEF* in developing CRC Research's dissemination strategy. The *DEF*'s simple design and ready to use format made it easy for the first author (Clifton-Ross) to develop a digital strategy based on its four main components: the "organization"; "assets and audiences"; "engagement strategies"; and "technologies and processes." To effectively employ this framework, she began by conducting a review of CRC Research as a research group. She did so by auditing their social media channels, reviewing their websites, and investigating their digital strategies to date. She subsequently identified their digital assets (i.e., websites, social media platforms, etc.) and investigated their existing audiences using their social media and website analytics. This helped her set a series of goals (i.e., increases in followers, retweets/shares, likes, website visitorship, etc.) and guide her research on best practices that would help achieve them.

She then located new target audiences and developed strategies to reach them (i.e., uncovering suitable users to follow on social media, promoting the work of others, etc.). She also established connectivity between the assets by cross-promoting them and by creating consistent, formulaic, and synchronistic content schedules for each social media platform. She also strategically scheduled a diversity of social media post types (i.e., image, blog, quote, link, video, or data visualization-based) that shared disseminated content under the umbrella of sustainable community development. She also adopted a 60/40 strategy, meaning 60% of posts featured content that was created by others (i.e., blogs, news posts, reports, peer-reviewed articles, etc.) while 40% promoted CRC Research outcomes.

Throughout this experiment, the first author (Clifton-Ross) identified which strategies were effective and which ones were not, and adjusted accordingly. This was especially important as the ebbs and flows of social media make it a moving target. It also helped to significantly increase CRC Research's social media analytics. For example, during the 2017-2018 period, post "likes" on the Facebook page increased by 43% over the previous year (Hodson, Dale & Clifton-Ross, 2019). Of the 306 total posts, they received 36,338 "impressions" (the number of times a post displayed in a news feed or on a page's timeline) and 20,077 in "reach" (the number of users who saw a page post in their news feed or on the page's timeline) which accounted for increases of 57% and 54%, respectively, over the previous year (2019). Twitter also saw increases during the same period. With a total of 520 tweets, there was an increase of 140% in "likes" and a 52% increase in "impressions" (CRC, 2019). This steady growth also occurred on the main CRC Research website during the 2017-2018 period as it received a total of 1,649 social referrals (the number of pageviews directed from social media), a boost of 41% over the previous year (2019). By addressing the four components of the *DEF*, CRC Research established an effective digital strategy that disseminated

their research outcomes more widely, increased public engagement via social media, and established a unique online voice and persona.

Curating Research Outcomes for Dissemination

Example 1: Use of Data Visualization, "Climate Spiral" GIF by Ed Hawkins

It is important to note that the practice of curating research outcomes online requires a process of reformatting or reimagining research outcomes (see Table 1 for examples). With a variety of possible mediums—including but not limited to blog posts, reports, data visualizations, maps, interactive charts, video games, images, videos, art, and music—academics tailor their research outcomes for different content types. An example of a successful data visualization is the infamous "Climate Spiral" created by climate scientist, Ed Hawkins. This fast-paced GIF (graphics interchange format) visually communicates the startling increase in global temperatures drawing on a series of temperature datasets spanning 1850-2016. Its simple design and fast-paced animation struck a chord with the public and subsequently went viral on social media, reaching millions of users. It was even featured in the opening ceremonies of the 2016 Rio Summer Olympic Games.

Example 2: Use of Music to Communicate Effects of Climate Change in Yellow Cedar Forests in Alaska, "Forest Changes of the Alexander Archipelago" and "Yellow Cedar of the Alexander Archipelago"

Another successful example of reformatted research outcomes is a project that transformed data into music. Titled "Forest Changes of the Alexander Archipelago" (Audio File 1) and "Yellow Cedar of the Alexander Archipelago" (Audio File 2), this project used data collected by Stanford PhD student, Lauren Oakes, that traced the effects of climate change on yellow cedar forests in Alaska (Blakemore, 2016). Her fellow PhD student, Nik Sawe, subsequently transformed her complex charts and numbers into music through "data sonification" technology (Kahn, 2016). The results were two hauntingly beautiful audio files that conveyed the effects of climate change through pitch and frequency of notes. This project ultimately provides researchers and the public with new ways of engaging with data, namely revealing new methods to detect data patterns and also express the effects of climate change on a visceral level (Kahn, 2016). As of January 30, 2019, the first audio file had received 7,576 plays on SoundCloud (Climate Central, 2016a) while the second audio file had received 3,636 plays (Climate Central, 2016b). The project also caught the attention of several online publications including *Scientific American, Climate Central, Smithsonian, Fast Company, HelloGiggles, Outside Online*, and *The Huffington Post*, which undoubtedly circulate the audio files to new audiences.

Example 3: Use of Video With Music and Art to Summarize an Article, "Sustainable Development for Some: Green Urban Development and Affordability," 2009, *Local Environment: The International Journal of Justice and Sustainability*

A reformatted example from the CRC Research catalog is a video summarizing a 2009 article published in the *Local Environment: The International Journal of Justice and Sustainability*, titled "Sustainable Development for Some: Green Urban Development and Affordability." Using the case study framework, the article examined how sustainable development often only addresses two concerns, the environment and the economy, and suggests that the social imperative should also be considered while planning for urban development projects. Because access is blocked by a paywall, limiting readership to the academic community (or those with the means to purchase individual articles or journal subscriptions), we created a 4 min and 55 s animated video illustrating core concepts and research outcomes presented in the article.

We reformatted the article using visual and auditory storytelling techniques in the following ways: (a) we wrote an engaging script, using plain language free of academic jargon, that summarized key concepts and research outcomes from the article; (b) we integrated the recorded script narration with lively open-source music; and (b) we created compelling paintings, drawings, and digital art that were brought to life through animation. The video was uploaded to the CRC Research Facebook page in April 2017. In just 7 weeks, it received over 450 organic views, with an organic reach of 929 users (the number of unique visitors who saw the content) and 50 organic post engagements (clicks, likes, shares, comments). While these figures are certainly not viral, as they were not generated through paid social media advertisement, the video "reached" nearly 1,000 Facebook users in as little as 7 weeks, many of which may not have previously been exposed to the original article. According to Taylor & Francis Online, the webpage listing the article received 1,901 views from August 2009 to July 2017 (Dale & Newman, 2009, para. 2). As of January 2019, it had received 2,531 views, an increase of 630 views in 17 months (Dale & Newman, 2009, para. 2). Our experiment with reformatting our journal article into a clear, compelling, and concise video ultimately helped us reach new audiences.

Table 1. Descriptions and examples of different curated media formats for disseminating research outcomes.

Curated Media Formats for Disseminating Research Outcomes	Descriptions and Examples
Data visualizations: GIFs, maps, interactive charts, video games, etc.	Reformat data into maps, charts, video games, or GIFs (graphics interchange format). This file type contains multiple frames in a single image file that plays in an animated sequence. See Example 1: "Climate Spiral" by Ed Hawkins
Music	Transform or transpose data into music. See Example 2: "Forest Changes of the Alexander Archipelago" and "Yellow Cedar of the Alexander Archipelago" by Lauren Oakes and Nik Sawe
Video	Create videos with compelling visuals (paintings, drawings, photographs) and music to summarize peer-reviewed journal articles. See Example 3: "Sustainable Development for Some: Green Urban Development and Affordability," in the *International Journal of Justice and Sustainability*, 2009.
Art	Use artworks to help bridge the arts with sciences and to communicate research outcomes on a visceral level. See Example: "Edging Forward: Reconciliation, Reconnection and Regeneration" exhibit
Links	Use of "Skim, Swim, Dive" framework when integrating links into length-restricted platforms (i.e., Twitter, blogs, etc.). Include links to reports, journal articles, etc. in video descriptions fields.
Exhibits/research displays	Use the "Ideas, Objects, People" framework when creating exhibits or research displays. Use a range of media types to appeal to different audiences (*ideas suggested media*: peer-reviewed articles and research reports; *objects suggested media*: art, images, videos data visualizations, maps, music; *people suggested media*: publishable interviews, blog posts, video and audio recordings, researcher profiles).
Websites and social media	Adopt the principles and practices of the "Digital Engagement Framework" to establish a consistent, formulaic, and synchronistic digital engagement and online dissemination strategy.

These three examples serve as key lessons for researchers, particularly those used to traditional academic publishing where no detail is too small to be included for reliability and replicability. When disseminating curated research outcomes on social media, for example, the notion of "reduction in the face of abundance" is of particular note (Cairns & Birchall, 2013, p. 5). However, it is important to direct users to publications or reports that further detail the research outcomes. One way that CRC Research addresses this concern is by drawing on the principles of the *Skim, Swim, Dive* framework discussed earlier. For example, including a direct link to a research report or the webpage featuring the journal article in the YouTube or Facebook video description is a simple way to encourage users to dive deeper into the research.

What is Research Curation?

The practice of research curation, that is, the dissemination of curated research outcomes, is a method to mobilize academic research to diverse audiences. This occurs through dynamic online communication channels that add value to content by adapting curatorial practices and dissemination methodologies developed in museums. It is a critical step toward enhanced knowledge mobilization as it can establish enlarged research contexts, integrate audience engagement strategies, present information through a range of interactive formats, and accelerate the transfer of research outcomes via social media channels. Building upon the three key engagement frameworks described earlier, research curation draws on storytelling techniques, visitor and audience studies, as well as digital engagement strategies to move beyond simply disseminating research outcomes to engaging diverse audiences. To this end, research is curated across social media platforms (Facebook, Twitter, Instagram, Pinterest, YouTube, etc.), and enhanced through data visualizations, videos, and artworks, and reflected on in blog posts and website content to establish multiple points of entry.

Hirsh (2017) argues that "authority is no longer dependent upon your institution, but rather your ability to provide a signal amid the (informational) noise that marks our new era" (para. 12). With the noise of the Internet and its ubiquitous use worldwide, the practice of strategically disseminating curated research outcomes using the frameworks discussed earlier and the strategies of reformatting research outcomes will not only provide clarity and guidance for users (Balzer, 2014), but will also help create smoke signals around your work, so to speak. To further enhance this, it is important to maintain connectivity and synchronicity between channels by referencing and linking to one another (Newell & Dale, 2015). This approach ensures that no online source—whether a social media channel, an online tool, such as our e-Dialogue system, or a research website—is "acting in isolation" (Newell & Dale, 2015), again adding to density and centrality of dissemination and knowledge transfer. This will ultimately help stimulate new readership by providing multiple entry points.

Conclusion

Our modern information age presents both opportunities and great challenges for information dissemination. Although Web 2.0 tools have opened up new and innovative channels for academics to disseminate their research outcomes, they

have also amplified the noise of the Internet. This makes it increasingly challenging to make research outcomes, aimed at increasing civic literacy around critical issues, visible and accessible to the broader public (Newell & Dale, 2015). Furthermore, with the popularization of social media, the nature of how people share and retrieve information has transformed. This brings up questions on how to best disseminate research outcomes through online channels, in addition to traditional methods (i.e., peer-reviewed journal, conference presentations, etc.).

The practice of disseminating curated research outcomes, or "research curation," is an applied method for addressing some of the challenges facing academic researchers. Namely, it provides a framework for how to tackle the online environment, how to reformat research outcomes into a variety of engaging mediums (i.e., videos, data visualizations, etc.), and how to engage the public. Although not synonymous with museum curation, "research curation" draws from the curatorial approaches that have evolved through museums. To maintain relevance and enhance visibility, academic researchers can and should build upon curatorial and communications practices pioneered in museums as these institutions have a long history of educating and engaging the public. Ultimately, it is through such strategies that we can effectively close the gap between academia and the public, which is essential for increasing civic literacy around the issues that threaten sustainability. We believe this is essential to solving the wicked, complex, and messy challenges we are facing today.

As the effectiveness of social media becomes increasingly reliant on paid ads to reach new and existing users, it can be challenging to disseminate curated research outcomes using organic reach. This social media metric measures the number of unique users that view content—whether on Facebook, Twitter, Instagram, or other social media platforms—that were reached without paid ads. And while there are several techniques for organic reach that have proven to be successful—including but not limited to joining online communities, creating content with entertainment value, maintaining a positive tone, integrating visuals into posts, ensuring content is adding value, and building trust from followers (Hodson, Dale, & Clifton-Ross, 2019)—there exists a research gap on the use of paid social media ads to disseminate academic research outcomes. As Facebook, Twitter, and Instagram continue to adjust their algorithms, paying to reach new and existing audiences has quickly become the easiest way to mobilize knowledge in a timely manner. However, this highlights an ethical dilemma of whether to use research funds for marketing-based activities. Furthermore, most frameworks or best practices for paid social media address retail and business endeavors. As a result, there is a lack of guidance on how academics can use such tools to effectively disseminate their research outcomes, given the fact that they are not theoretically selling anything.

Another interesting area for further research is the integration of Instagram into the academic dissemination toolkit. As this social media platform has over 1 billion users, it is an ideal space for disseminating curated research outcomes as it can offer unprecedented reach to large audiences in a short period of time. For example, the use of images to communicate climate change research can be persuasive when coupled with storytelling (Hodson, Dale, & Peterson, 2018) and can reach the many networks of users through strategic hashtag use. However, there is a gap in research on how images and artworks can best serve as visual representations of research outcomes. Given the nature and scale of issues our world is facing, it would be invaluable to learn more about how this dissemination method can engage new audiences, establish cultural relevance, and communicate research on a visceral level.

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